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THE WHEATS OF BALUCHISTAN, KHORASAN AND THE KURRAM VALLEY

BY

GABRIELLE L. C. HOWARD, M.A.

Second Imperial Economic Botanist

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THE WHEATS OF BALUCHISTAN, KHORASAN AND THE KURRAM VALLEY.

BY

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THE WHEATS OF BALUCHISTAN.

I. INTRODUCTION.

In 1909, the subject of the improvement of wheat cultivation in this Agency was taken up in response to a request from the Revenue Commissioner of Baluchistán. In order to obtain some knowledge of the varieties of wheat grown, samples of ripe ears, together with details of the cultivation, were sent from each District. These wheats present several interesting features from the systematic standpoint, and from the point of view of the distribution of varieties in India on account of the proximity of Baluchistán to Central Asia—the source of so many immigrations into India and the probable original home of the wheat plant of antiquity. A careful examination and classification of the wheats of this region has therefore been made and the forms the subject of the present paper. Some account of the cultivation has also been included as the agricultural and climatic conditions of Baluchistán are to some extent unique and are very different from those of India.

The country of Baluchistán forms a transition between the plains of India and the elevated plateaux and mountain systems of Central Asia. It includes the plains of Nasírábád, Sibi and Kachhi (which resemble Sind in almost all respects) and high valleys such as that of Quetta, five thousand feet above the sea and the Toba plateau, the elevation of which is seven thousand feet. The Agency includes Districts directly under British administration and also territory which is under political control only, such as the States of Kalát and Las Bela. The range in altitude and climatic conditions is very great.

Generally speaking, only a small part of the Agency consists of plains, some of low elevation—such as those of Nasírábád and Sibi, the Kachhi plain in Kalát and the littoral of Makrán and Las Bela—and some at higher altitudes such as the Toba and Chaman plains and the Dák in Chágai. By far the largest part consists of ranges of mountains, sometimes of great altitude, intersected by long narrow valleys. Cultivation is restricted to portions of the plains and valleys and most of the area is quite uncultivable. Practically no monsoon rain is received. Bare hills, a general absence of vegetation, except in patches where irrigation is possible, are the characteristic features of a Baluchistán landscape. In some parts, in the direction of Persia, particularly in Chágai, large sandy deserts occur.

The climate varies with the altitude. In the low plains, the conditions resemble those in Sind and in the Punjab, namely, a long, intensely hot summer and a moderate winter. In the higher valleys, where the elevation varies from three to six thousand feet, the year can be divided into four distinct seasons. The winter is very cold with snow and frost and the summer is moderately hot. Great diurnal variations in temperature are a characteristic of the climate. Places of intermediate elevation, such as Chaman and Chágai have an intermediate climate, while the very highest valleys, such as the Toba plateau, are practically deserted in winter, the larger portion of the population migrating to lower altitudes after the crops are sown.

The annual rainfall is everywhere small and varies from 12 inches at Sháhrig to 3 inches in Makrán. Most of the rain falls in connection with the cold weather depressions which pass over the country from the Persian plateau but there are also some minor storms due to the monsoon current. The precipitation is greatest in the highlands and is mostly derived from the winter storms. On the low-lying plains, the rainfall is very small and is mostly received in July and August. The general condition of drought is accentuated by the strong, dry winds which are prevalent in most parts of Baluchistán. These not only dry out the soil very markedly but also, by increasing the transpiration of the plants, increase their consumption of water. The heat of the sun even in the uplands is intense and in some dry farming experiments carried out at Quetta it was found impossible to produce, with ordinary implements, a mulch deep enough to conserve during July and August the moisture of the previous winter rains from the combined effect of sun and wind.

Irrigation.

To ensure a crop, irrigation in some form or other is almost always necessary. A good deal of so-called unirrigated cultivation is carried on but

most of this is really cultivation rendered possible by the water received from the hill torrents. The methods of irrigation employed are very various.

(1) *Rivers and streams.* Owing to the mountainous nature of the country, rivers and hill torrents are numerous. In only a few of the rivers, however, is there any considerable amount of permanent water. Many consist only of a shallow stream, except when flooded by rain from the hills, while in others the bed is quite dry for a large part of the year. Where the ground is soft, as in parts of Kalát, the rivers, on reaching the plain, divide into numerous small streams and are thus immediately available for irrigation. In the rivers with a permanent flow, dams are made of brushwood and earth and the water is led away in open channels. These dams are generally constructed and owned by a hamlet or by a family, who keep them in repair and divide the water thus obtained among the members. Some of these dams are very large. The Mamak dam in the Mula, Kachhi took 700 pairs of bullocks two months to erect. Owing to the flimsy nature of their construction, these dams are continually being breached by the force of sudden floods.

In Makrán, where the rivers often form a series of deep pools, irrigation is carried out by leading the water from these pools on to the fields by open channels. In the case of hill torrents, the fields are embanked and the flood water is led on to them by open channels whenever possible.

(2) *Canals.* These are only to be found in Nasírábád, Sibi, and near Pishin.

(3) *Springs.* Springs are common in the highlands of the Agency, and are much used for irrigation. If the spring is a large one, the water is led directly by open channels on to the land; if it is small, a reservoir is constructed. Water has also been obtained by artesian borings in the Quetta District.

(4) *Kárézes.* The *káréz* is a very ancient form of irrigation peculiar to Baluchistán and Persia. It consists of a series of wells connected by an underground channel. The first well is usually on the talus below the hills and the series is continued until the water debouches on the surface and can be run direct on to the fields. A *káréz* is generally owned by a family or tribal group and the water is shared by time—thus if twelve members own equal shares, each in turn will use the entire flow for twenty-four hours. Repairs are carried out by the headman at the expense of the owners.

(5) *Wells.* Well irrigation is not much practised except in parts of Sibi and parts of Kachhi where the practice is said to be increasing.

Generally speaking, the methods of irrigation practised are extremely wasteful and nothing is more surprising in such an arid region than to see how little care and thought have been expended by the inhabitants in conserving and using to the best advantage the small amount of water available.

The Cultivation of Wheat.

Wheat is the principal crop of the uplands, while in the plains of Sibi and Kalát the *khárif* crops are more important. The crop is grown under irrigation and on rainfall only. Irrigated wheat is generally sown from October to December. Usually the land is watered and the seed sown broadcast, after which, it is ploughed in and covered with the beam. In some cases, the seed is sown in the dry ground and watered afterwards. The number of subsequent waterings varies with the locality but is generally considerable and may be as many as seven. In January and February, the crop is grazed. Harvest extends from May to July, according to the altitude. The grain is trodden out by bullocks, often assisted by a threshing frame. Owing to the prevalence of wind, separation is easy and is generally carried out by a four-pronged wooden fork. The grain heap is sealed with earthen seals until the division can be carried out. The revenue in some Districts is still taken in kind.

Rain-fed wheat is often drilled, both in embanked fields which have been flooded and also in land moistened by rain only. The yield depends on the spring storms. The crop is generally a very small one, never yielding more than 5 or 6 maunds to the acre.

Irrigated wheat is generally heavily manured in the neighbourhood of towns and villages, while rain-fed wheat is always unmanured. Land being so much more plentiful than water, an extensive system of fallowing is practised. Irrigated wheat land is always fallowed for at least a year ; sometimes if the land is very poor for as long as ten years. Rain-crop land, on the other hand, is not fallowed. It is probable that the real effect of the fallow is to aerate the soil, which is very poor in humus and which, after the constant irrigation under a strong sun, bakes into a cement-like mass. In the neighbourhood of Quetta, wheat seldom ripens normally and does not develop the proper amount of colour in the chaff and grain. It withers rather than ripens and the grain is always shrivelled. This is due to the fact that during the ripening period, when the temperature rapidly rises, moisture is quickly lost from the baked surface while air can no longer penetrate to the roots of the plant. Under such circumstances, the wheat dries up rather than matures.

A method of growing wheat with one irrigation, followed by the use of implements for breaking the surface crust, has been worked out at the Quetta Fruit Experiment Station. On unmanured land, a greater yield was obtained from this single preliminary irrigation than by the people on similar land with seven irrigations. A full account of these experiments will be found elsewhere.[1,2] The adoption of this improved method of production, which is well within the means of the local *zamindar*, would not only increase the yield per acre but would also enable a much larger area to be put under wheat with the amount of water at present available. The wheat produced would moreover be better developed and of higher quality. It is probable that the introduction of an early maturing variety would also prove beneficial.

Grain Quality.

There is a general consensus of opinion that the Baluchistán wheats are not of good quality. They are said to be markedly inferior to those of the Punjab, which are much preferred for food. As none of the Punjab wheats, however, have really good quality or strength[3] it would appear that the Baluchistán wheats are particularly poor. This is due partly to the system of cultivation and partly to the nature of the varieties grown. The grain has all the characteristics of weak wheat.

In order to throw further light on the local ideas regarding the inferiority of these wheats, two samples from Baluchistán were included among a number of Indian samples sent in 1909 to Mr. A. E. Humphries, Past President of the Incorporated National Association of British and Irish Millers, for complete milling and baking tests. One of the samples represented the ordinary red wheat of Quetta and was obtained through Khan Bahadur B. J. Patel, C.I.E., of the St. John's Mills, Quetta. The other was a sample from Mastung obtained through the Political Adviser to the Khan of Kalát. Mastung wheat is supposed to be markedly superior to the other wheats of Baluchistán. The following is the report[4] received from Mr. Humphries. It will be seen that neither sample was of good quality.

"*Baluchistan wheats.* The twenty-nine lots included two, named No. 1 Mastung and Red Quetta, both of which I understand came from Baluchistán.

[1] Annual Report of the Imperial Economic Botanists, Pusa, 1914-15.

[2] Howard and Howard, *Bulletin No. 4 of the Quetta Fruit Experiment Station, 1915.*

[3] One of the most important characteristics of a wheat from the point of view of consumption is its "strength" by which is meant the capacity of the resulting flour to make large, well-shaped loaves. The same grain qualities which produce a good loaf also produce a good *chapati*.

[4] Howard and Howard, *Bulletin No. 22 of the Agr. Res. Institute, Pusa, 1911.*

The former sample contained mostly soft white wheat but it also contains some soft red and some hard red wheat. This lack of uniformity in texture is a bad point, one to which British buyers attach much importance. It behaves very well in the conditioning and milling processes. In the notes on appearance which I dictated as a first stage in these investigations I said 'nothing special at all in this sample. Should be surprised if it yields strong flour.' Nor does it. It is Indian wheat of an ordinary undistinguished type.

The red Quetta contains a large proportion of white wheat similar to the Mastung. The berries are irregular in shape and comprise some very hard, and some soft by nature. This kind does not appear to be strong and it is not so. The description I have used concerning Mastung applies to red Quetta also. The baker's note concerning the flavour of the bread from these two kinds is 'Very dry, very chaffy. Tastes like flour itself.' The last remark, if inaccurate, is expressive. No wonder the natives prefer durums to such varieties for their own food."

That there is nothing inimical to the production of strong wheats in the climate or soil of Baluchistán has been shown by the behaviour of some of the improved Pusa wheats at Quetta. Pusa 4, Pusa 6 and Pusa 12, all wheats with good quality, have been grown at the Fruit Experiment Station during the last few years. The samples obtained show that these strong wheats do not deteriorate in quality under the new conditions.

Unfortunately few of the Indian wheats are suitable for distribution in Baluchistán on account of the nature of their root development. The root system which suits the plains of India is not well adapted to withstand the drought and cold of Baluchistán, which necessitate a much deeper and stronger rooting power. In 1910, however, some crosses were made between Pusa wheats of good quality and some high-yielding English kinds.[1] Many of the progeny have very strong rooting power and it is possible that some of the new wheats derived from these crosses will be found suitable. For the Quetta valley, an early maturing variety with good quality would be a great benefit particularly as the new system of cultivation if adopted would lead to a better development and ripening of the grain.

Classification.

As regards the systematic aspect of the subject, the method employed in former publications,[2,3] for the classification of the wheats of India has

[1] Annual Report of the Imperial Economic Botanist, 1913.

[2] Howard and Howard, *Memoirs of the Department of Agr. in India* (*Bot. Ser.*) vol. 2, no. 7, 1909.

[3] Howard and Howard, *Wheat in India*, Calcutta, 1910.

been adopted. This scheme was based on the sub-division of *Triticum sativum* Lam. into six sub-species and on the botanical varieties proposed by Koernicke.[1]

Triticum sativum Lam. Ears with a fertile terminal spikelet and brittle or tough rachis. Outer glumes shorter than the flowering glumes, with or without a blunt tooth at the side. Palea as long as the flowering glumes, undivided.

I. Rachis brittle. Grain enclosed in the glumes when threshed.

1. *Triticum spelta* L. Spelt. Ears bearded or beardless, long and thin, lax and somewhat square. Outer glumes very broad and truncated with a very short and blunt apex and a somewhat undeveloped keel.

2. *Triticum dicoccum* Schrk. Emmer. Ears nearly always bearded, dense, broader on the two-rowed side, outer glumes sharply keeled with an acute apex.

II. Rachis tough. Grains separating from the chaff when threshed.

3. *Triticum compactum* Host. Dwarf wheats. Ears bearded or beardless, extremely short and very compact, more or less quadrangular. Outer glumes keeled above, rounded below. Straw very short and stiff. Grains rounded.

4. *Triticum turgidum* L. Rivet wheats. Ears bearded, large and four-sided with the spikelets closely packed on the rachis. Straw very tall, stiff, often solid. Grains large, short, and plump with a blunt apex.

5. *Triticum durum* Desf. Macaroni wheats. Ears large, dense with long awns. Outer glumes sharply keeled to the base. Straw stiff, usually solid. Grains long, somewhat pointed and hard.

6. *Triticum vulgare* Vill. Common wheats. Ears bearded or beardless, more or less lax (much laxer than *T. compactum*). Outer

[1] Koernicke, *Die Arten und Varietäten des Getreides*, Berlin, 1885.

glumes keeled above, rounded below. Straw hollow, medium in length. Grains not rounded, more than twice as long as broad.

It must be admitted that the distinctions between the sub-species are not always very clear and that intermediate forms can be found combining characters from two sub-species. Koernicke pointed out that brittleness of the rachis, persistence of the glumes round the grain and the peculiar glume-shape is not always well defined in all the forms of *T. spelta*. On the other hand, the glume-shape of *T. spelta* is sometimes to be found in forms belonging to *T. vulgare* and *T. compactum*. He also emphasized the difficulty of distinguishing between *T. durum* and *T. turgidum*. This difficulty was encountered in the present survey. *Orbasin* wheat from Fort Sandeman (Baluchistán Class VIII) could with almost equal justice be assigned to either of these two sub-species. As Koernicke[1] points out, the ultimate decision must in such cases always be a subjective one depending on the emphasis laid by the individual observer on any particular character. In the case of *T. compactum* and *T. vulgare*, the distinctions based on the glume and grain shape break down utterly. In the Himalayan tracts, a large number of wheats are found which combine the ear-shape and the general characters of *T. vulgare* with glumes and grain as rounded as in a typical *compactum*. It is often possible to find in the same sample two wheats identical in every respect except that one has rounded glumes and rounded grain and in the other the glume-shape typical of *T. vulgare* with long grain.

This has been pointed out in a previous publictaion[2] but was found to be even more striking in the case of many of the Baluchistán wheats. It is a curious fact that wheats of this type are not to be found in the plains of India although some of the Bengal wheats approximate to this condition. Such wheats have been found in the Himalayas near Simla, in Baluchistán and also in Khorásán. The yield of these wheats must necessarily be small as they are always very lax and the grain is of small size. The short glume of a *T. compactum* combined with the rachis of an ear of *T. vulgare* leads to the production of a structure inefficient in the extreme from the point of view of yield. It is possible therefore that those forms represent the survival of an old type of wheat which has been replaced in the plains of India by higher yielding forms of *T. vulgare*. On the other hand, they bear a close resemblance to the progeny obtained by crossing *T. compactum* and *T. vulgare* and the regions

[1] Koernicke, l.c.

[2] Howard and Howard, *Wheat in India*, l.c.

in which they occur are regions of great aridity in which natural crossing is common. It is possible therefore that they represent the result of such crossing. As, however, at the present time, no dwarf wheats are found in any of the localities mentioned, this would appear to be improbable.[1]

In the conception of the variety, the definition of Koernicke[2] has been followed. A variety is considered to be a group of forms distinguishable from other forms by some definite botanical or morphological character which can be easily recognized in any well-grown individual and conversely, the individual forms comprised in the group should be indistinguishable among each other by any such character. Botanical or morphological characters may be defined as those which remain constant with change of environment or season and which can be determined in the laboratory from properly developed specimens.

In contradistinction to botanical characters are agricultural or field characters which cannot be distinguished in the laboratory or from individual plants but can only be fully appreciated in the field in pure cultures, grown side by side, under uniform conditions. Such characters are time of maturity, height, susceptibility to rust.

As the classification of the wheats in this paper is of necessity based on ripe specimens, the only characters which could be employed were botanical or morphological ones and the classification therefore does not go beyond the botanical variety.

The characters employed by Koernicke in grouping his system of botanical varieties were the following in the order given :—

(*a*) Ears bearded or beardless.
(*b*) Felted or smooth chaff.
(*c*) Colour of the chaff (red, white, or black).
(*d*) Colour of the grain (red or white).

An examination of a much larger number of forms than those which were at the disposal of this observer and also the results of modern investigations on the inheritance of characters in wheat have shown that the alternatives enumerated above by no means cover the number of characters available for the distinction of botanical varieties. To take the first case, "ears bearded or beardless," it has been recently pointed out that the degree of bearding,

[1] Since the above was written wheats of the type described have been obtained in the F_2 of a cross between a macaroni and an ordinary wheat.

[2] Koernicke, l. c.

that is the length and arrangement of the awns, on a wheat, may vary in several ways.[1] An entirely beardless wheat is rare. In India, particularly, a large number of wheats are neither fully bearded nor entirely beardless, but possess short awns of varying length. These awns may be so short as to form small tips to the glumes or the wheats may appear to be half-bearded. The long awns on a fully bearded ear are due to two factors, each of which when present alone, produces a half-bearded ear which breeds true to this character. Various types of bearding are shown in Plate I. It is evident that any system in which only two alternatives, bearded and beardless ears, are considered is incomplete and will result in the grouping together of a large number of very different forms. In the same way it has been shown that the felting in some wheats is due to the presence of two kinds of hairs, while in others only one kind is present. The difference is easily recognizable macroscopically on single ears by the density of the felting.

Although it has also been demonstrated that the red colour of the chaff and grain is not uniform in all wheats, but varies in tone owing to the presence or absence of several factors for red colour,[2, 3] nevertheless this is not of great significance in a botanical classification, as it is impossible to distinguish accurately such differences except by breeding. It is sometimes possible to distinguish two wheats by the tone of colour of their chaff but such distinctions can only be seen in the bulk and must remain of very minor importance. They can have no place in the main divisions of a classificatory scheme.

Two other characters which are not considered in the above scheme can, however, be very usefully employed in addition and these are glume-shape and grain-shape. As pointed out above, the distinctions between the subspecies based on glume-shape break down to some extent. Wheats belonging to *T. vulgare* may be found with distinctly rounded glumes. This is an easy character to determine in dried specimens and is therefore very suitable for use in a botanical classification. Grain-shape is also a character which can be employed as a means of distinguishing one wheat from another. Examination of the progeny of a large number of crosses shows that this character is definitely inherited and is not materially influenced by changes in environment. A certain amount of practice is required before the eye can distinguish the different forms of grain but any one accustomed to handle wheat

[1] Howard and Howard, *Memoirs of the Dept. of Agr. in India* (*Bot. Ser.*), vol. III, no. 6, 1913, and vol. V, no. 1, 1915.

[2] Nilsson Ehle, *Kreuzungsuntersuchungen an Hafer und Weizen*. Lund, 1909.

[3] Howard and Howard, *Mem. of the Dept. of Agr. in India* (*Bot. Ser.*), vol. III, no. 6, 1913.

TYPES OF BEARDING

can make out the components of a mixed sample with tolerable accuracy. There are four shapes which are most frequently found and which have been employed as an aid to classification in the present paper: the ordinary long grain, which is the best known form, the short or truncated form, i.e., one in which the end appears to have been cut off, the rounded form, and the form in which the dorsal side is raised. This latter bears some resemblance to the hump of a camel and as a word was required to describe it shortly, the term "humped" has been employed. All four forms are shown very much enlarged in Figure 1.

Another character which is useful is the colour of the straw. Many Indian wheats exhibit a pink tinge on the straw on ripening. The pink colouring matter turns black when the straw is quite ripe and gives the latter a grey or purple appearance. This peculiar colour of the straw is easily seen and is a definitely inherited character.

Fig. 1.—Grain-shape in wheat.

Enough has been said to show that modern investigations have rendered the scheme of botanical varieties proposed by Koernicke somewhat out-of-date. There are three principal reasons why the scheme is no longer adequate. In the first place, the characters chosen do not present simple alternatives such as presence or absence of awns but may be present to different degrees. In the second place, the characters employed are too few and, as a result, many wheats, obviously different even on a macroscopic examination in the laboratory, fall into one variety. Thirdly, as material from other parts of the world has become available, new forms have been found necessitating new varietal names. For instance, there is no varietal name for a bearded wheat with black awns, red and black chaff and white grain although such wheats occur in Bihar. The need for a revised systematic scheme for wheat is obvious, but such a scheme must be based on examination of wheats from all parts of the world and to devise a new scheme for the Indian wheats by themselves would only add to the confusion and would prove of no ultimate advantage.

In the present paper the botanical varieties, as defined by Koernicke, have been subdivided where necessary into classes, the class distinctions being based on the degree of bearding, felting, the tone of colour of the chaff, glume-shape, shape of the grain and colour of the straw.

As regards the terms bearded and beardless, all wheats in which the awns are half an inch or more long have been classed among the bearded varieties, but in the descriptions the term bearded has been qualified by such term as fully bearded and half-bearded. As the samples had to be sent long distances and were collected and despatched by subordinate officials with little or no knowledge of the care necessary in sending specimens, it is not surprising that a good deal of breakage took place, especially of the awns. This has made it difficult, in some cases, to determine the degree of bearding, and it is possible that this may not always have been quite accurately described.

There is a curious want of colour about the wheats both from Baluchistán and Khorásán. The red colour of the chaff and of the grain, if present, is pale and poorly developed. In the plains, white-chaffed or white-grained wheats are really yellow in colour and it is only a convention to term them white, but in these arid regions they approximate more to a true white and have a dead or dull appearance. It is probable that this want of development both of the red and the yellow colouring matter is due to the conditions under which the wheat ripens. As pointed out above, constant irrigation under a hot sun and wind, by producing a cement-like condition of the soil impermeable to air, induces withering rather than ripening.

The most striking point about the Baluchistán wheats is the large number of different kinds cultivated. Two varieties of rivet wheats which could be subdivided into three classes, four varieties of macaroni wheats falling into six classes, one variety of *compactum* and eighteen varieties of *T. vulgare* comprising fifty-four classes were found. Considering how small the actual area under cultivation is, this was somewhat unexpected. Baluchistán is the only part of India in which rivet wheats occur.

II. CLASSIFICATION AND DESCRIPTION OF THE TYPES.

A. CLASSIFICATION OF THE WHEATS OF BALUCHISTÁN.

Triticum turgidum L. Rivet wheats.

Glumes felted.

A. Glumes white, awns black.

a. Grain white.

var. *Salomonis* Keke.

Baluchistán Class I.

2. Glumes smooth.

A. Glumes white.

a. Grain white.

var. *nemausense* Wittm.

Baluchistán Class II. Ears short, much broader at the base than at the top; awns black.

Baluchistán Class III. Ears long, not markedly broader at the base; awns white; glumes with a white bloom.

TRITICUM DURUM DESF. MACARONI WHEATS.

1. Glumes felted.

A. Glumes white, awns black.

a. Grain white.

var. *melanopus* Al.

Baluchistán Class IV. Ears very lax and slender; glumes very long with well-marked lateral ridges; grain exceptionally long even for a macaroni wheat.

Baluchistán Class V. Ears long, less lax and thin than in Class IV; lateral ridges not prominent; no black colour on glumes; grain very long.

Baluchistán Class VI. Ears short and dense; a good deal of black on the glumes; grain somewhat short.

2. Glumes smooth.

A. Glumes red, awns red.

a. Grain red.

var. *murciense* Keke.

Baluchistán Class VII.

b Grain white.

var. *hordeiforme* Host.

Baluchistán Class VIII.

B. Glumes white, awns black.

a. Grain white.

var. *leucomelan* Al.

Baluchistán Class IX.

TRITICUM COMPACTUM HOST. DWARF WHEATS.

I. Ears beardless.

1. Glumes smooth.

A. Glumes white.

a. Grain white.

var. *Humboldti* Keke.

Baluchistán Class X.

TRITICUM VULGARE VILL. COMMON WHEATS.

I. Ears bearded.

1. Glumes felted.

A. Glumes red.

a. Grain red.

var. *barbarossa* Al.

Baluchistán Class XI. Ears quadratic in section, dense; awns black.

Baluchistán Class XII. Ears medium to lax: awns black: glumes somewhat short and rounded with some black colouring; grain small and rounded.

Baluchistán Class XIII. Ears long and lax: awns and chaff reddish brown; grain rather large; straw strong.

Baluchistán Class XIV. Ears short, somewhat dense: chaff red with a bluish bloom; grain short, somewhat rounded; straw thin to medium.

b. Grain white.

var. *turcicum* Keke.

Baluchistán Class XV. Ears long and lax: chaff reddish brown, hairs long and dense.

Baluchistán Class XVI. Ears long, laxer than in Class XV: chaff pale red with a bluish bloom.

Baluchistán Class XVII. Ears short and somewhat lax: glumes short and rounded: grain short and round.

B. Glumes greyish white with some black; awns black.

var. *fuliginosum* Al.

Baluchistán Class XVIII. Ears long, lax, bold; awns short and spreading; grain large humped, pale red; straw very stout and strong.

Baluchistán Class XIX. Ears long, lax, not bold; awns not spreading; grain neither humped nor rounded, somewhat dark red; straw medium.

Baluchistán Class XX. Ears short, medium to dense; awns not spreading; grain small, rounded, pale red; straw medium.

C. Glumes white, awns white.

a. Grain red.

var. *Hostianum* Clem.

Baluchistán Class XXI. Ears medium in length, fully bearded, awns long; grain somewhat large, red.

Baluchistán Class XXII. Ears medium to long, fully bearded, awns short; grain dark red, long.

Baluchistán Class XXIII. Ears short and thin, fully bearded; glumes rounded, short, very white; grain short, round, pale red.

Baluchistán Class XXIV. Ears partly bearded; glumes short and rounded; grain small, humped; straw thin.

Baluchistán Class XXV. Very similar to Class XXIV but ears bolder and larger; grain larger; straw stout and strong.

b. Grain white.

var. *meridionale* Keke.

Baluchistán Class XXVI. Ears fully bearded; glumes not rounded; grain long, not humped.

Baluchistán Class XXVII. Ears fully bearded; glumes not rounded; grain short, not humped.

Baluchistán Class XXVIII. Ears partly bearded; glumes rounded; grain very humped and short. These might possibly be considered as beardless.

Baluchistán Class XXIX. Ears with long tips or short beards; glumes rounded; grain white, short, very humped; straw strong.

Baluchistán Class XXX. Ears with long tips which are often black; glumes rounded; grain not humped; straw weak.

2. Glumes smooth.

A. Glumes red, awns black.

a. Grain red.

var. *caesium* Al.

Baluchistán Class XXXI.

B. Glumes red, awns red.

a. Grain red.

var. *ferrugineum* Al.

Baluchistán Class XXXII. Ears large and bold, fully bearded; chaff brownish red; grain pale red, large.

Baluchistán Class XXXIII. Ears thin, fully bearded; chaff pale red with bluish bloom; grain smaller than in Class XXXII and of a lighter red.

Baluchistán Class XXXIV. Ears thin, partly bearded; glumes slightly rounded; chaff reddish brown; grain dark red.

Baluchistán Class XXXV. Ears short and thin, slightly bearded; glumes rounded; chaff reddish brown; grain pale red.

b. Grain white.

var. *erythroleucon* Kcke.

Baluchistán Class XXXVI. Ears fully bearded; chaff brownish red with a bluish bloom; grain long not humped.

Baluchistán Class XXXVII. Ears fully bearded; glumes slightly rounded; chaff pale red with bluish bloom; grain with a distinct hump.

Baluchistán Class XXXVIII. Ears fully bearded; chaff brownish red with no bluish bloom; grain somewhat humped.

Baluchistán Class XXXIX. Ears partly bearded, lax; glumes somewhat rounded; chaff with bluish bloom; grain without a hump.

C. Glumes white, awns white.

a. Grain red.

var. *erythrospermum* Keke.

Baluchistán Class XL. Ears bold, large, fully bearded; awns stiff and spreading; grain dark red, large, short, humped; straw very strong.

Baluchistán Class XLI. Ears lax, not bold, fully bearded; awns not spreading; grain dark red, humped; straw medium, no pink colour.

Baluchistán Class XLII. Ears medium and slender, fully bearded, awns long not spreading; both awns and glumes with a pink tinge, grain short, not humped, medium sized, light red; straw weak, pink.

Baluchistán Class XLIII. Ears medium; chaff with a reddish tinge; grain on the whole not humped.

Baluchistán Class XLIV. Ears long, lax and slender; chaff quite white; grain humped.

b. Grain white.

var. *graecum* Keke.

Baluchistán Class XLV.

II. Beardless.

1. Glumes felted.

A. Glumes red.

a. Grain red.

var. *pyrothrix* Al.

Baluchistán Class XLVI. Ears medium to long; beardless with very short tips; chaff reddish brown.

Baluchistán Class XLVII. Ears short, quite beardless; chaff red with a certain amount of bluish bloom; straw pink turning black on ripening.

b. Grain white.

var. *Delfii* Keke.

Baluchistán Class XLVIII. Ears long and medium in density; chaff red with bluish bloom.

Baluchistán Class XLIX. Ears short and dense with a fan-shaped apex ; chaff reddish brown.

B. Glumes white.

a. Grain red.

var. *velutinum* Schübl.

Baluchistán Class L. Ears with many short tips ; chaff yellowish white ; grain rounded ; straw not pink.

Baluchistán Class LI. Ears quite beardless ; chaff yellowish white ; grain not rounded ; straw not pink.

Baluchistán Class LII. Ears quite beardless or with one or two short tips ; chaff very white ; straw pink.

b. Grain white.

var. *leucospermum* Kcke.

Baluchistán Class LIII. Ears bold and large, dense with fan-shaped apices, flattened ; grain short and small ; straw extremely strong, pink turning black on ripening.

Baluchistán Class LIV. Ears medium, not flattened ; grain short and small ; straw fairly strong, pink turning black on ripening.

Baluchistán Class LV. Ears with well-marked tiny tips ; glumes somewhat sharply keeled ; grain longer than in Classes LIII and LIV ; straw thin not pink.

2. Glumes smooth.

A. Glumes red.

a. Grain red.

var. *milturum* Al.

Baluchistán Class LVI. Ears not flattened, tapering at the top ; grain pale red.

Baluchistán Class LVII. Ears flattened, broader at apex ; grain light red.

b. Grain white.

var. *alborubrum* Kcke.

Baluchistán Class LVIII. Ears long, medium ; grain round not humped.

Baluchistán Class LIX. Ears short, dense with fan-shaped apices ; grain very small, round not humped.

Baluchistán Class LX. Ears lax; glumes rounded; grain humped.

B. Glumes white.

a Grain red.

var. *lutescens* Al.

Baluchistán Class LXI.

b. Grain white.

var. *albidum* Al.

Baluchistán Class LXII. Ears tapering at the top, medium to lax; straw thin; grain not rounded.

Baluchistán Class LXIII. Ears dense, very bold, with fan-shaped apices; grain very small, round; straw very strong.

Baluchistán Class LXIV. Ears dense, small, with fan-shaped apices; grain medium sized, not rounded; straw weak.

B. DESCRIPTION OF THE WHEATS OF BALUCHISTÁN

Triticum turgidum L. Rivet wheats.

Ears square and dense, bearded; glumes sharply keeled to the base; straw stout, stiff and solid; grain plump, short, rounded, very large.

var. *Salomonis* Keke.

Baluchistán Class I. Ears short, broader at the base than at the top; awns black; glumes felted, white; grain white, soft.

Wheats belonging to this class were found in *Pandaro* wheat from Panjgúr, Makrán and in *Pashmak* wheat from Khárán, Kalát.

var. *nematasense* Willm.

Baluchistán Class II. Ears short, broader at the base than at the top; awns black; chaff white, smooth; grain white, soft.

Pashmak wheat from Chágai belongs to this class. This wheat is only cultivated in the Kallagh settlement of the Ráskoh Range and occurs nowhere else in the District. It is used almost exclusively to make porridge as the flour does not bind well enough for *chapattias*. It requires a good supply of irrigation water. The same wheat also formed part of the sample of *Pashmak* wheat from Khárán, Kalát.

Baluchistán Class III. Ears very long, apex and base about the same breadth, awns white ; chaff smooth, white with a white bloom ; grain white, soft.

Wheat belonging to this class was found in *Spín ghanam* from Sháhrig, Sibi.

TRITICUM DURUM DESF. MACARONI WHEATS.

Ears flat, flowering glumes with long awns : outer glumes sharply keeled to the base ; straw stiff and solid ; grains long.

var. *melanopus* Al.

Baluchistán Class IV. Ears very lax and slender ; awns long and black ; glumes exceedingly long with well-marked lateral ridges, somewhat sparsely felted except on the ridges, white ; grains exceptionally long even for macaroni wheats and much compressed laterally, white.

A specimen of this wheat termed *Mecca Muazzama ghanam*, Mecca wheat, was received from the Kila Saifulla tahsíl of the Upper Zhob Sub-division. As the name implies, this variety is supposed to have been imported from Mecca in very small quantity by *hajis*. It is considered so sacred that it cannot be sown without performing the ceremony of ablution which is necessary for the offering of prayers. Any increase in the cultivation of this variety is hindered by the great respect in which the grain is held by Mohammadan agriculturists. Its chief use appears to be to neutralize the effect of the evil eye in a field. A single ear identical with the above was found in a specimen of *Wadának* wheat sent from Duki.

The wheat known as *Siah das* in Khorásán is probably identical with this.

Baluchistán Class V. Ears long, medium, less lax and thin than in Class IV ; awns long and black ; glumes long, lateral ridges not prominent, felted, white with no blackening ; grain white, hard, exceptionally long even for a macaroni wheat ; straw pink.

To this class belongs a wheat from Duki known as "*Wadának* of the Punjab." It is an introduced wheat and is only cultivated on a very small scale in a few places. It is probably identical with Type I of the Punjab wheats.[1]

Baluchistan Class VI. Ears short and dense ; awns black (an intense shining black) ; glumes with a good deal of blackening ; grain dark amber hard, somewhat short for a macaroni.

[1] Howard and Howard, *Wheat in India*, p. 177.

To this class belongs *Tor ghanam* from Fort Sandeman, Lower Zhob, the name having reference to the black glumes. A few ears of the same wheat were found in a sample of *Pindaro* wheat from Panjgúr, Makrán.

Malão ghanam wheat from Músa Khél, Loralai belongs either to Class V or Class VI. It is only grown on irrigated land but is said to be in general cultivation.

var. *murciense* Keke.

Baluchistán Class VII. Ears medium in length and medium in density; awns light red; chaff smooth, light red; grain red.

Wheats belonging to this class were only found in small quantities in a sample of *Pindaro* wheat from Panjgúr, Makrán and in a sample of *Sra ghanam* from Fort Sandeman, Lower Zhob.

var. *hordeiforme* Host.

Baluchistán Class VIII. Ears very short and dense; awns light red; chaff smooth, light red; grain rather short and humped, soft, white.

The wheats belonging to this class bear some resemblance to rivet wheats. The grain is shorter and more humped than is generally the case with macaroni wheats, and some difficulty was experienced in correctly classifying them. On the whole, however, they appear to have more in common with the subspecies T. *durum*.

Orbasín ghanam from Fort Sandeman, Lower Zhob belongs to this class. A very small quantity of the same wheat was also found as an impurity in *Tor ghanam* from the same locality.

var. *leucomelan* Al.

Baluchistán Class IX. Ears medium in length, dense; awns with some blackness; chaff smooth, white with a reddish edge; grain not humped, soft, long, white.

About half the sample of *Pindaro* wheat from Panjgúr, Makrán, consisted of a wheat belonging to this class.

Triticum compactum Host. Dwarf wheats.

Ears very dense and short, rarely over two inches long; outer glumes keeled in the upper half and rounded in the lower half; straw very short and stiff; grains rounded.

var. *Humboldti* Kcke.

Baluchistán Class X. Ears very short, beardless ; glumes smooth, white ; grain small, round, white, hard.

Wheats belonging to this species are not cultivated in Baluchistán although they are fairly common in the adjacent Province of the Punjab. Only a very small quantity of a wheat belonging to this class was found as an impurity in two samples of wheat *Thori* and *Wáru*, both from Gandáva, Kachhi, Kalát.

Triticum vulgare Vill. Common wheats.

Ears bearded or beardless ; outer glumes not keeled to the base ; straw hollow ; grain neither very long nor round.

var. *barbarossa* Al.

Baluchistán Class XI. Ears quadratic in section, dense and somewhat short, bearded ; awns black ; chaff densely felted with long hairs, pale red ; grain red.

Only one wheat belonging to this class was found in *Mátoshag* from Kéch, Makrán.

Baluchistán Class XII. Ears bearded ; glumes somewhat short and rounded, felted, reddish brown with some black ; grain red, small and rounded.

Wheat belonging to this class was only found as an impurity in very small quantity.

Baluchistán Class XIII. Ears long, bearded ; awns reddish brown ; chaff felted, reddish brown ; grain pale red, rather large ; straw strong.

Wheats belonging to this class were also found in small quantity only as impurities in *Spín ghanam* from Sanjáwi, Loralai ; in *Spín ghanam* from Bori, Loralai ; in *Spín ghanam* from Kila Saifulla, Upper Zhob ; in a sample of *Bati razi* from some district unknown and in a sample from Mach.

Baluchistán Class XIV. Ears short, somewhat dense, bearded ; awns short and light red ; glumes red with a bluish bloom ; straw thin to medium ; grain short, red, somewhat rounded.

This was found in very small quantity as an impurity in a sample of wheat from Mach and in *Thori* wheat from Nasírábád, Sibi.

var. *turcicum* Keke.

Baluchistán Class XV. Ears long and lax, bearded; awns red; glumes densely felted with long hairs, reddish brown; grain white, soft, straw fairly strong.

To this class belong *Spin ghanam* from Bori, Loralai, and *Spin ghanam* from Kila Saifulla, Upper Zhob. Similar wheats occurred in *Sára ghanam* from Duki, Loralai; in *Spin ghanam* from Sanjáwi, Loralai; in *Kajani* or *Borji* wheats from Sibi *tahsil*, Sibi; in *Soor ghanam* from Shahrig, Sibi; and in *Turki* wheat from Dálbandin, Chágai.

Baluchistán Class XVI. Ears longer and laxer than in Class XV, bearded; glumes felted but hairs are less dense and shorter than in the previous class; grain white, soft; straw stronger than in Class XV.

Wheat belonging to this class was found in very small quantity only as an admixture in *Bajri* from Nasírábád, Sibi.

Baluchistán Class XVII. Ears short, lax, bearded; glumes short and rounded; densely felted as in Class XV, reddish brown; grain short, rounded, white, soft.

This was only found as an admixture in small quantity in two samples from Mach.

var. *faligimosum* Al.

Baluchistán Class XVIII. Ears long, lax, bearded, with short, spreading, black awns; glumes somewhat rounded, felted, white; grain large, humped, somewhat like rivet grain, red, soft; straw very stout and strong.

This wheat was found as an admixture in *Kamar ghanam* from Chanan, Quetta-Pishín; in *Spin ghanam* from Kákar Khorásán, Lower Zhob, and in *Sara ghanam* from Bori, Loralai.

Baluchistán Class XIX. Ears long and lax, less bold than in Class XVIII; awns black but not spreading; glumes felted, greyish white; grain neither humped nor rounded, somewhat dark red; straw medium.

Wheats belonging to this class occurred in *Wáza* from Dhádar, Kachhi Kalát, in *Siah das* from Dálbandin, Chágai; in *Pámbarin* and *Toda* wheats from Quetta and in two samples from Mach.

Baluchistán Class XX. Ears short, medium to dense, bearded; awns long, black, not spreading; glumes felted, greyish white; grain pale red, short, rounded soft; straw medium.

Wheats belonging to this class occurred in small quantity as admixtures in *Bajri* and *Thori* wheats from Nasírábád, Sibi; in *Thori* wheat from Gandáva, Kachhi, Kalát; in *Urbsen* wheat from Músa Khél, Loralai; in *Sára ghanam* and *Laghar* from Bori, Loralai and in *Tor ghanam* and *Sra ghanam* from Fort Sandeman, Lower Zhob.

This variety *fuliginosum* occurs only as an admixture and nowhere forms the bulk of the wheat cultivated. Punjab Type 9, a very distinctive wheat of the Punjab known as the *Ratti* of Montgomery belongs to this variety and it is probable that some has found its way into Baluchistán.

var. *Hostianum* Clem.

Baluchistán Class XXI. Ears medium in length, and density; awns long and white; glumes felted, white; straw strong; grain somewhat large, red, shape ordinary.

Wheats belonging to this class were found as admixtures in *Dahak* wheat from Panjgúr, Makrán; in *Bajri* wheat from Nasírábád, Sibi; in *Kali ghanam* from Chaman, Quetta-Pishín; in *Lakhi* wheat from Bárkhán, Loralai; in *Zizha* wheat from Músa Khél, Loralai,; in *Toda* wheat from Quetta, in *Dahgak* from Nushki, Chágai and in *Turki* wheat from Dálbandin, Chágai.

Baluchistán Class XXII. Ears medium to long, medium in density; awns short; glumes felted, white; grain dark red, long, hard.

Wheats belonging to this class occurred as admixtures in *Shahderzi* wheat, in *Bati razi* wheat and in five samples from Mach.

Baluchistán Class XXIII. Ears short and thin; medium to lax: awns white; glumes short and rounded, felted, white; grain pale red, short, round; straw weak.

Wheats belonging to this class were found as admixtures in *Kamar, Sára* and *Spín* wheats from Pishín; in *Pambarin* and *Spín* wheats from Quetta; in *Godewoda* wheat from Chaman, Quetta-Pishín and in three samples from Mach.

Baluchistán Class XXIV. Ears medium in length, lax, partly bearded (*i.e.*, beards not so long as in fully bearded wheats); glumes short and felted, white; grain small, short, red, soft, distinctly humped in shape; straw thin.

Wheats belonging to this class were found as admixtures in *Ghat ghanam* from Fort Sandeman, Lower Zhob, in *Saloman razi, Khuda daderzi, Kumar*

and *Shahdarzi* wheats, in a sample of white wheat from Nushki. Chágai in *Turki* wheat from Dálbandin. Chágai; in *Sra ghanam* from Kila Saifulla, Upper Zhob and in a sample from Mach.

Baluchistán Class XXV. This is very similar to the last class but the heads are larger and bolder, the grain is larger and the straw strong and stout.

This was only found as an admixture in one sample of *Kamar* wheat from Chaman, Quetta-Pishín.

var. *meridionale* Ecke.

Baluchistán Class XXVI. Ears fully bearded, medium in density; glumes felted, white; grain white, somewhat long, shape normal.

Kamar ghanam from Chaman, Quetta-Pishín, belongs to this class and also another sample from some place unknown labelled *Kamar*. Wheats belonging to this class also occurred as impurities in *Toda* wheat from Quetta; in *Bajri* and *Thori* wheats from Nasírábád, Sibi; in *Spín ghanam* from Chaman, Quetta-Pishín; in *Spín ghanam* from Kákar Khorásán, Lower Zhob; in *Sra ghanam* from Hindubágh, Upper Zhob; in *Sára ghanam* from Bori and *Sawjáwi*, Loralai; in five samples named *Khuda dadarzi*, *Madar khashkába*, *Shahdarzi*, *Bati razi* and *Salaman razi*; and in *Turki* wheat from Dálbandin, Chágai.

Baluchistán, Class XXVII. This class is very similar to the above but differs in glume and grain shape, the latter being smaller and shorter.

Wheats belonging to this class occurred as admixtures in a sample from Quetta, in *Kamar* and *Spín* wheat from Pishín and in four samples from Mach.

Baluchistán Class XXVIII. Ears not quite fully bearded, medium to lax in density, medium in length; glumes rounded, felted, white; grain white, short and very humped in shape; straw strong and pink.

To this class belong *Pandbarin* from Quetta; a sample named *Madar khashkába*; *Spín* wheat from Pishín; and two unnamed samples from Quetta; *Spín* wheat from Hindubágh, Upper Zhob; *Spín ghanam* and *Kali ghanam* from Chaman, Quetta-Pishín and four samples from Mach. Wheats belonging to this class were also found as admixtures in *Kamar ghanam* and *Godewoda* wheat from Chaman, Quetta-Pishín and in *Kamar* wheat from Pishín.

Baluchistán Class XXIX. Ears with very short, white awns; glumes rounded, felted, white; grain white, in shape very much humped; straw strong.

To this class belong *Turki* wheat and an unnamed sample from Nushki, Chágai ; *Turki* wheat from Dálbandin, Chágai and five samples named *Salomon razi, Bati razi, Shahderzi, Khuda dadarzi,* and *Kamar ; Spín* wheat from Hindubágh, Upper Zhob ; and *Spín ghanam* from Sháhrig, Sibi.

Baluchistán Class XXX. Ears with small tips, often black ; glumes felted, white, rounded ; grain white, normal in shape.

To this class belong *Ghat ghanam* from Fort Sandeman, Lower Zhob ; *Spín koshám* from Kila Saifulla, Upper Zhob ; *Laghar* wheat from Bori, Loralai ; and similar wheats occurred as admixtures in *Sára ghanam* from Bori, Loralai ; in *Sra ghanam* from Fort Sandeman, Lower Zhob, and in a sample from Mach.

It is difficult to say whether these two Classes XXIX and XXX should be assigned to var. *meridionale* Ecke. or to var. *leucospermum* Ecke., that is whether the wheats should be considered bearded or beardless.

var. *caesium* Al.

Baluchistán Class XXXI. Ears small with small glumes, somewhat lax, fully bearded ; awns black ; glumes smooth, red with a good deal of black; grain red, small ; straw somewhat weak. All the specimens received were immature which would point to this being a late kind.

To this class belong *Chirok* from Kéch, Makrán ; and *Siah das* from Dálbandin, Chágai. A similar wheat also occurred in *Dahyak* from Nushki, Chágai.

var. *ferrugineum* Al.

Baluchistán Class XXXII. Ears large, medium in length, bold, lax, fully bearded ; glumes brownish red, shiny ; grain pale red, large, plump ; straw weak to moderately strong.

To this class belong *Sára ghanam* from Duki, Loralai and similar wheats occurred as admixtures in *Spín ghanam* from Sarjáwi, Loralai ; *Spín ghanam* from Kila Saifulla, Upper Zhob ; *Kahani* or *Bujri* wheat from Sibi ; *Wára* wheat from Dhádar, Kachhi, Kalát ; *Rodi* and *Lákhi* wheat from Bárkhán, Loralai ; *Bujri* from Nasírábád, Sibi ; in a sample from Kohlu, Sibi ; in *Soor ghanam* from Sháhrig, Sibi ; *Dahyak* wheat from Nushki, Chágai, ; *Spín ghanam* and *Sára ghanam* from Bori, Loralai.

Baluchistán Class XXXIII. Ears smaller and less bold and lax than in Class XXXII, fully bearded, awns red; glumes smooth, pale red with a bluish bloom; grain medium sized, smaller than in Class XXXII and a paler red in colour.

To this class belongs *Sar ghanam* from Kákar Khorásán, Lower Zhob and similar wheats occurred as admixtures in *Spin ghanam* and *Sára ghanam* from Pishín; in *khushkába* wheat from Chaman, Quetta-Pishín; in *Tor gharam* from Fort Sandeman, Lower Zhob; in a sample named *Salemon razi* and in four samples from Mach.

Baluchistán Class XXXIV. Ears thin, lax, medium in length, bearded but awns short, awns red; glumes slightly rounded, smooth, reddish brown; grain somewhat dark red.

Wheats belonging to this class were found as admixtures in *Pandbarra* wheat from Quetta; *Dahak* wheat from Panjgúr, Makrán and in two samples from Mach.

Baluchistán Class XXXV. Ears short, small, thin, bearded, with very short awns; glumes rounded, smooth, reddish brown; grain pale red.

Wheats belonging to this class were found as admixtures in *Kamar* wheat from Pishín, in a sample named *Madar khushkába* and in three samples from Mach.

var. *erythroleucon* Keke

Baluchistán Class XXXVI. Ears medium in length and density, fully bearded, awns red; glumes smooth, brownish red with a bluish bloom; grain white, somewhat long, normal in shape.

To this belongs *Bajra* from the Nasírábád and Sibi *tahsils* Sibi and *Spin ghanam* from Sanjáwi, Loralai. Similar wheats were also found as admixtures in *Thori* wheat from Nasírábád, Sibi and in *Sára ghanam* from Duki, Loralai.

Baluchistán Class XXXVII. Ears medium in density, fully bearded, awns red; glumes slightly rounded, smooth, pale red with a bluish bloom; grain white with a distinct hump; straw strong. To this class belong three samples from Mach and similar wheats were found as admixtures in *Kamar* and *Spin* wheat from Pishín; in an unnamed sample from Quetta; in *Sar ghanam* from Kákar Khorásan Lower Zhob and in four samples from Mach.

Baluchistán Class XXXVIII. Ears medium in length and density, fully bearded, awns red; glumes smooth, brownish red with no bluish bloom; grain white, somewhat humped.

To this belong *Wáru* wheat from Dhádar, Kachhi, Kalát; *Rodi* wheat from Bárkhán, Loralai; *Urbsen* wheat from Músa Khél, Loralai and similar wheats belonging to this class were found as admixtures in a sample from Kohlu, Sibi: in *Spín ghanam* from Kila Saifulla, Upper Zhob: in *Laghar*, *Spín ghanam*, and *Sára ghanam* from Bori, Loralai; in *Toda* and *Pambarin* wheats from Quetta: in *Lakhi* wheat from Bárkhán, Loralai; in *Dahyak* wheat from Nushki, Chágai and in two samples named *Madar khushkába* and *Bati razi*.

Baluchistán Class XXXIX. Ears somewhat lax, bearded but awns very short; glumes somewhat rounded, smooth, brown with a bluish bloom; grain white not humped.

To this belong *Pambarin* wheat from Quetta and seven unnamed samples from Mach, similar wheats occurred as admixtures in two other samples from Mach.

var. *erythrospermum* Kcke.

Baluchistán Class XL. Ears lax, very bold, fully bearded but awns more spreading than in the next two classes; glumes smooth, white; grain dark red, somewhat large, short and humped; straw very strong.

To this class belong *Sarbaj* wheat from Quetta, and one sample of *Spín ghanam* from Kákar Khorásán, Zhob. Similar wheats were found as admixtures in *Spín ghanam*, from Hindubágh, Upper Zhob; and in three samples of *Spín ghanam* from Kákar Khorásán, Lower Zhob.

Baluchistán Class XLI. Ears less bold than in Class XL but larger than in Class XLII, lax; awns less spreading than in Class XL but stiffer and shorter than in XLII: chaff smooth, white; grain fairly large, dark red, humped; straw moderately strong, no pink colour.

To this class belong *Soor ghanam* from Sháhrig, Sibi: two samples from Kohlu, Sibi: *Khosha* and *khushkába* wheat from Chaman, Quetta-Pishín; *Spín ghanám* from Duki, Loralai: *Sára ghanam* from Bori, Loralai: *Zizha* wheat from Músa Khél, Loralai: *Lakhi* from Bárkhán, Loralai: *Dahyak* wheat from Dálbandin, Chágai and *Dahyak* wheat from Nushki, Chágai. Similar wheats were found as admixtures in *Spín ghanam* from Sháhrig, Sibi; in *Kamar*, *Spín*, *Godewoda* and *Sarmani* wheats from Chaman, Quetta-Pishín; in *Sara ghanam* from Sanjáwi, Loralai; in *Laghar* from Bori, Loralai; in *Urbsen* from Músa Khél, Loralai; in *Rodi* from Bárkhán, Loralai; in *Siah das* and *Turki* wheats from Dálbandin, Chágai and in a sample of white wheat from Nushki, Chágai.

Baluchistán Class XLII. Ears medium in density, slender, bearded with long, rather weak awns; chaff smooth, white, both awns and chaff having a pinkish tinge; grain small, pale red, not humped; straw weak, pink in colour, turning black on ripening.

To this class belong *Sra ghanam* from Kila Saifulla, Upper Zhob; *Sra ghanam* from Hindubágh, Upper Zhob; *Sra ghanam* from Fort Sandeman, Lower Zhob; *Bajri* from Nasírábád, Sibi; Red *Toda* from Quetta, Quetta-Pishín; *Wára* from Dhádar, Kachhi, Kalát; *Thari* from Gandáva, Kachhi, Kalát; *Dahak* and *Shatar dandan* from Panjgúr, Makrán, Kalát. Similar wheats were found in some samples of *Bajri* from Nasírábád, Sibi; in *Wára* from Gandáva, Kachhi, Kalát; in *Pambarin* and white *Toda* from Quetta, and in *Ghat ghanam* from Fort Sandeman, Lower Zhob.

Baluchistán Class XLIII. Ears fully bearded but awns shorter than in Class XLII whereas the ears are longer and very lax; glumes smooth, white; grain long, dark red; straw not pink.

Wheats belonging to this class were found as admixtures in some samples named *Salomán razi*, *Bati razi*, *Shaderzi*, *Kamar* and *Khuda dadarzi* which all came from the same locality.

Baluchistán Class XLIV. Ears fully bearded, longer and laxer than in Class XLII; grain humped, light red, small.

To this class belong four unnamed samples from Mach. *Kamar* wheat from Pishín, Quetta-Pishín and similar wheats occur as admixtures in six samples from Mach, in *Spín* wheat from Pishín and in an unnamed sample from Quetta, Quetta-Pishín.

Sára wheat from Pishín is very similar to the wheats in this class but has pink straw.

var. *graecum* Ecke.

Baluchistán Class XLV. Ears medium to lax, fully bearded; glumes white, smooth; grain white.

To this class belong *Spín ghanam* from Kákar Khorásán, Lower Zhob; *Sarmani* wheat from Chaman, Quetta-Pishín; *Spín ghanam* from Duki, Loralai; *Dholi* wheat from Bárkhán, Loralai; white *Toda* wheat from Quetta, Quetta-Pishín and similar wheats were found as admixtures in *Bajri* from Nasírábád, Sibi; in *Godewoda*, *Kamar ghanam*, *Khashkába ghanam* and *Spín ghanam* from Chaman, Quetta-Pishín; in *Sra ghanam* from Hindubágh and Kila

Saifulla, Upper Zhob; in an unnamed sample from Kohlu, Sibi; in *Shutur dandan* from Panjgúr, Makrán; in *Sára ghanam* from Bori, Loralai; in *Sára ghanam* from Sanjáwi, Loralai; in *Zizha* wheat from Músa Khél, Loralai; in *Lakhi* wheat from Bárkhán, Loralai; in *Pambarin* and red *Toda* wheats from Quetta; in *Wára* from Dhadar, Kachhi, Kalát; in *Spín*, *Kamar* and *Sára* wheats from Pishín; in two unnamed samples from Quetta; in *Dahyak* wheat from Nushki, Chágai; in nine samples from Mach; in a sample named *Madar khashkába* and in some samples named *Saloman razi*, *Bati razi*, *Shahderzi* and *Kumar*, which all came from the same locality.

var. *pyrothrix* Al.

Baluchistán Class XLVI. Ears medium to long, in density medium to lax; beardless with very short tips; glumes felted, reddish brown; grain small, short, somewhat rounded, pale red; straw strong.

Wheats belonging to this class were found as admixtures in *Thori* and *Phundni* wheats from Nasírábád, Sibi; in *Lal reli* from Sibi *tahsíl*, Sibi; in *Baj* wheat from Dhádar, Kalát; and in *Thori* and *Wára* wheats from Gandáva, Kachhi, Kalát.

Baluchistán Class XLVII. Ears short, medium to lax, quite beardless; glumes red with a slight bluish bloom; grain short, somewhat rounded, red; straw pink, turning black on ripening. Wheats belonging to this class were found as admixtures in five samples from Mach.

var. *Delfii* Keke.

Baluchistán Class XLVIII. Ears medium to long, medium in density, beardless with small tips; glumes felted, red with a bluish bloom; grain short, small, somewhat rounded, white and generally soft.

To this class belong *Thori* wheat from Nasírábád, Sibi; *Lal Reli* from Sibi *tahsíl*, Sibi; *Baj* wheat from Dhádar, Kalát; *Wára* wheat from Gandáva, Kachhi, Kalát and similar wheats were found as admixtures in *Phundni* and *Bajri* wheats from Nasírábád, Sibi; in *Borji* wheat from Sibi *tahsíl*, Sibi and in three samples from Mach.

Baluchistán Class XLIX. Ears short, dense, almost like those in *T. compactum*, flattened, with a fan-shaped apex, beardless with short tips; glumes felted, reddish brown with no bloom; grain white.

To this class belong three samples from Mach and a similar wheat was found as an admixture in *Phundni* wheat from Nasírábád, Sibi.

var. *edatinum* Schübl

Baluchistán Class L. Ears medium to long and medium to dense, beardless with many short tips; glumes felted, white; grains small, round, pale red, soft.

Wheat belonging to this class was found as an admixture in *Thori* wheat from Nasírábád, Sibi.

Baluchistán Class LI. Ears medium to long and medium to dense, quite beardless; glumes felted, white; grain somewhat small and short, humped, red.

Wheats belonging to this class were found as admixtures in *Thori* wheat from Nasírábád, Sibi and in *Thori* wheat from Gandáva, Kachhi, Kalát.

Baluchistán Class LII. Ears short to medium in length, medium to dense, beardless or with a few small tips; glumes felted and very white; grain pale red; straw pink.

Wheats belonging to this class were found as admixtures in eight samples from Mach.

var. *leucospermum* Keke.

Baluchistán Class LIII. Ears bold and large, dense with fan-shaped apex, flattened, quite beardless or with tiny tips; glumes felted, white; grain very short and small but not humped, white; straw extremely strong and probably pink.

To this class belongs *Reli* from Dhádar, Kachhi, Kalát and *Turki* from Nushki, Chágai. A similar wheat was found as an admixture in *Wára* from Gandáva, Kachhi, Kalát.

Baluchistán Class LIV. Ears medium in length and density, beardless or with very small tips; glumes not rounded, felted, white; grain short, small but not humped, white; straw fairly strong, pink.

To this class belong five samples from Mach and similar wheats were also found in three other samples.

Baluchistán Class LV. Ears with well-marked, short tips; glumes somewhat sharply keeled, felted, white; grain white, longer than in Class LIV; straw thin, not pink.

Wheats belonging to this class were found as admixtures in *Thori* and *Phundni* wheats from Nasírábád, Sibi, and in *Thori* wheat from Gandáva, Kachhi, Kalát.

var. *milturum* Al.

Baluchistán Class LVI. Ears medium to dense, beardless except for short tips : glumes smooth, red ; grain very pale red ; straw strong.

Wheats belonging to this class were found in *Wáru* and *Thori* wheats from Gandáva, Kachhi, Kalát : and in two samples from Mach.

Baluchistán Class LVII. Ears dense, flattened, apex tends to be fan-shaped, beardless with very distinct tips ; grain very small, light red ; straw strong.

A wheat belonging to this class was found as an admixture in *Thori* wheat from Nasírábád, Sibi.

var. *alborubrum* Keke.

Baluchistán Class LVIII. Ears long, medium to dense, beardless with somewhat long tips : glumes smooth, red with a slight bluish bloom ; grain small, short, somewhat rounded but not humped, white ; straw medium, pink.

Koto wheat from Kéch, Makrán belongs to this class and similar wheats were found as admixtures in *Thori* and *Bujri* wheats from Nasírábád, Sibi ; in *Báj* wheat from Dhádar, Kachhi, Kalát ; in *Wáru* wheat from Gandáva, Kachhi, Kalát, and in *Lal reli* wheat from Sibi *tahsíl*, Sibi.

A wheat occurring as an admixture in three samples from Mach probably also belongs to this class but the grain appears slightly longer.

Baluchistán Class LIX. Ears short and dense with a fan-shaped apex, flattened, beardless with distinct tips : glumes pale red with a slight bluish bloom : grain short, small, somewhat round but not humped, white ; straw thin to medium.

Phandni wheat from Nasírábád, Sibi, belongs to this class and similar wheats belonging to this class were found as admixtures in *Thori* and *Bujri* wheat from Nasírábád, Sibi.

Baluchistán Class LX. Ears lax, beardless with short tips : glumes rounded, smooth, brownish red : grain small, somewhat humped, not rounded, white.

A wheat belonging to this class was found as an admixture in a sample from Mach.

var. *lutescens* Al.

Baluchistán Class LXI. Ears short, medium in density with short tips ; glumes smooth, white : grain short, small not humped, light red ; straw pink.

Wheats belonging to this class were found as admixtures in *Thori*, *Phandai* and *Bajri* wheats from Nasírábád, Sibi; in *Kandai* and *Urbeen* wheats from Músa Khél, Loralai; in *Thori* from Gandáva, Kachhi, Kalát, and in six samples from Mach.

var. *albidum* Al.

Baluchistán Class LXII. Ears medium to lax, beardless with distinct tips; glumes smooth, white; grain white; straw thin, pink.

To this class belong *Thori* wheat from Nasírábád, Sibi, and an unnamed sample from Mach.

Wheats belonging to this class were found as admixtures in *Bajri* and *Phandai* wheats from Nasírábád, Sibi; in *Thori* wheat from Gandáva, Kachhi, Kalát; in six samples from Mach and in *Ghat ghavam* from Fort Sandeman, Lower Zhob.

Baluchistán Class LXIII. Ears dense and very bold, beardless, apex fan-shaped; glumes white, smooth; grain very small and round, white; straw pink and very strong.

A wheat belonging to this class was found as an admixture in *Red* wheat from Dhádar, Kalát.

Baluchistán Class LXIV. Ears dense and very short, not bold, beardless, apex fan-shaped; glumes smooth, white; grain medium in size, not rounded, white; straw thin.

To this class belongs *Kandai* wheat from Músa Khél, Loralai.

III. THE WHEATS IN EACH DISTRICT.

SIBI.

This District adjoins the Punjab and certain of the *tahsils* resemble in climate and physical aspects the neighbouring parts of Sind. The District is a large one, 11,281 sq. miles, but only a third of this is directly administered, the rest being under political control only. Great variations in altitude occur. The Sibi and Nasírábád *tahsils* which abut on Sind form a level plain, never above 500 feet in altitude. The remainder of the District consists of mountainous country with high mountains and narrow valleys, of which the principal are the Harnai valley (56 miles long by 6 miles broad), the Kach valley (4 miles long by 1 mile broad) and the Kowas and Ziarat valleys.

The climate naturally varies with the altitude. The highlands resemble the other places of high elevation in Baluchistán and enjoy a cool summer

but a very cold winter, with their greatest rainfall in the winter months. The plains of Sibi and Nasírábád have a very long, excessively hot summer, and a very scanty rainfall, which occurs mostly in July and August. The Shahríg *tahsíl*, which has an elevation of 2,300—4,500 feet is intermediate in climate. The amount of precipitation varies with the altitude. The average rainfall at Shahríg is 11·51, at Kach 11·06, at Sibi 4·95, and at Babar Kach 6·09 inches.

The only large rivers are the Nári and its tributaries. The permanent water of this river is made available for irrigation purposes in Sibi by means of a masonry regulator erected at Nári gorge in 1904. This replaced the temporary dams which used to be constantly washed away by floods.

Irrigated cultivation predominates: out of a total of 298 villages, 198 are completely secured by irrigation and only 12 are quite unirrigated. Two canals, the Begari canal and the Desert or Shahiwa canal, both from the River Indus, supply Nasírábád. About 90 per cent. of the cultivation in this *tahsíl* is dependent on the canals, which are generally filled in June and closed in January. The water is either carried on to the land by gravitation or lifted by a Persian wheel. In the Sháhríg *tahsíl*, springs are the main source of water but a certain number of *kárézes* also exist. In Kohlu, most of the cultivation is carried out on flood irrigation. A few *kárézes* are also found in this locality.

A much larger variety of crops can be grown in this District than in many parts of the Agency, and wheat does not therefore occupy so prominent a position. In the Sibi *tahsíl*, 13,515 acres out of 37,717 acres were under wheat in 1904-05, in Sháhríg 5,793 acres out of 9,777 acres and in Nasírábád 2,656 acres out of 83,739.

In the Sibi and Sháhríg *tahsíls*, wheat is generally grown on irrigated land only, but it may also be grown as a dry crop if the rainfall is exceptionally good. In Nasírábád, very little is grown and in Kohlu it is usually grown as an unirrigated crop.

Manure is commonly used in the Sháhríg *tahsíl*, and the land is often improved by adding the ashes of the burnt stubble of wheat and rice. Wheat and rice are grown in alternate years or successively for two or three years, or *juar* may follow wheat in which case the land requires a fallow. In other parts, manure is not so much used and, instead, the land is allowed to lie fallow for one or more years. In Kohlu, one year fallows are common, while in Nasírábád the land may remain uncropped for two or three years. In the Sibi *tahsíl*, the custom varies in different parts. There may be two crops in three years or one crop in three years or even one crop in five years.

In the plains, wheat is sown in irrigated lands in October and November and reaped in April. In the valleys of high elevation, the land is ploughed in the spring and summer and watered in October. When the land has dried sufficiently, the seed is scattered broadcast and ploughed in. The second watering is given fifteen days after germination, the third about the middle of January and the fourth at the beginning of March. After this the wheat is irrigated every ten or fifteen days.

The average yield of wheat in maunds per acre is as follows :—

	Nasirabad	Sibi	Shahrig	Kohlu
Land irrigated and manured	18·9		13·4 to 21·4	
Land irrigated but not manured	17·5	12·5		19
Dry crop land	-	-	13·6	14·5

Nasirábád tahsíl.

1. Thori. Seven samples of this wheat from seven different villages were sent. It is said to be grown for export and to be the best wheat in the District. The name *Thori* signifies bald or without awns. The samples were very mixed and the main constituent was not the same in each. It would appear therefore that *Thori* is not a variety but a group of wheats which resemble one another in being beardless and in having white grain. In three samples, the chief constituent was a beardless wheat with red, felted glumes, in two samples a beardless wheat with smooth, white chaff and one sample had equal quantities of these two. One sample was too unripe and damaged to examine.

1. *Thori from the village of Gandakha.* There were no less than ten different wheats in this sample. The main constituent was a beardless wheat with red, felted chaff and white grain (var. *Delfii* Keke. Class XLVIII).

2. *Thori from the village of Khudadad.* This sample contained eight different wheats. A beardless wheat with smooth, white chaff, white grain and pink straw was present to the largest extent (var. *albidum* Al. Class LXII).

3. *Thori from the village of Dadpur.* About two-thirds of the sample consisted of a beardless wheat with red, felted chaff and white grain (var. *Delfii* Keke. Class XLVIII). There were five other wheats present.

4. *Thori from the village of Manjhipur.* About one-third of this sample consisted of the beardless, smooth, white-chaffed wheat (var. *albidum* Al. Class LXII) and one-third of the beardless, felted, red-chaffed wheat (var. *Delfii* Ecke. Class XLVIII). About one-sixth consisted of a beardless wheat with light red, smooth chaff, white grain and pink straw (var. *alborubrum* Ecke. Class LVIII), and another sixth of a similar wheat with no pink colour in the straw and with fan-shaped apices on the ears (var. *alborubrum* Ecke. Class LIX). Three other wheats were present in small quantity.

5. *Thori from the village of Dheeran.* This was a fairly pure sample of the beardless wheat with red, felted chaff and white grain (var. *Delfii* Ecke. Class XLVIII). Three other wheats were present in small quantity.

6. *Thori from the village of Lehri Domki.* This was a fairly pure sample of the beardless wheat with smooth, white chaff (var. *albidum* Al. Class LXII). Four other wheats were present.

The following impurities were present :—

(i) A beardless wheat with long ears, smooth, red chaff, white grain and pink straw (var. *alborubrum* Ecke. Class LVIII) in samples 1, 2, 3, 5 and 6.

(ii) A similar wheat without pink straw and with short, dense ears with fan-shaped apices (var. *alborubrum* Ecke. Class LIX) in samples 1, 2, 3 and 4.

(iii) A beardless wheat with rounded, smooth, white glumes, and small red grain (var. *lutescens* Al. Class LXI) in samples 1, 2, 3 and 6.

(iv) A beardless wheat with white, felted chaff and white grain (var. *leucospermum* Ecke. Class LV) in samples 2 and 6.

(v) A beardless wheat with dense ears, smooth, red glumes and small, bright red grain (var. *milturum* Al. Class LVII) in sample 1.

(vi) A beardless wheat with small tips, white, felted glumes and small, pale red grain (var. *velutinum* Schübl. Class L) in sample 1.

(vii) A similar wheat with quite beardless ears (var. *velutinum* Schübl. Class LI) in sample 2.

(viii) A beardless wheat with felted, red glumes and red grain (var. *pyrothrix* Al. Class XLVI) in samples 1, 3, 4 and 5.

(ix) A fully bearded wheat with smooth, white glumes and white grain (var. *graecum* Ecke. Class XLV).

(x) A fully bearded wheat with smooth, red glumes and white grain (var. *erythroleucon* Ecke. Class XXXVI) in samples 1 and 3.

(xi) A fully bearded wheat with white, felted glumes and white grain (var. *meridionale* Keke. Class XXVI) in sample 3.

(xii) A bearded wheat with black awns, felted, greyish white chaff and pale red grain (var. *fulginosum* Al. Class XX).

(xiii) A bearded wheat with short, dense ears, red, felted, rounded glumes and red grain (var. *barbarossa* Al. Class XIV) in sample 1.

II. Phandni. This is said to be very similar to *Thori* and is quite as good in quality. It is generally exported and has the same market value as *Thori*. Irrigated land is used for the cultivation. Only one sample of this wheat was received. The ears are beardless and dense with fan-shaped apices. The chaff is smooth, light red with a bluish bloom and the grain is white. The straw is pink, turning black on ripening (var. *alboradiatum* Keke. Class LIX). There were also present in fair quantity, as impurities, two beardless wheats with red, felted chaff and white grain (var. *Delfii* Keke. Class XLVIII and Class XLIX), and in small quantity a similar wheat with red grain (var. *pyrothrix* Al. Class XLVI); a beardless wheat with smooth, white chaff and white grain (var. *albidum* Al. Class LXII); a similar wheat with red grain (var. *lutescens* Al. Class LXI); and a beardless wheat with white, densely felted chaff and white grain (var. *leucospermum* Al. Class LV).

III. Bajri. This variety is considered to be of inferior quality and is cheaper than *Thori* or *Phandni*. Six samples were received very different in composition. "*Bajri*" which means "bearded" is the name of a group of wheats rather than of any particular variety.

In three samples, the main constituent was a fully bearded wheat with smooth, red glumes and white grain, in one sample it was a similar wheat with white chaff. One sample was a mixture in equal parts of a bearded wheat with smooth, white chaff and white grain, and of a similar wheat with red grain. The sixth sample was a mixture of all these four wheats.

1. *Bajri from the village of Khanpur.* This sample was a mixture of two bearded wheats with smooth, white chaff, the one with white grain (var. *graecum* Keke. Class XLV), the other with red grain (var. *erythrospermum* Keke. Class XLII). There was only one impurity, a bearded wheat with black awns, white, felted glumes and red grain (var. *fulginosum* Al. Class XX).

2. *Bajri from the village of Dheeran.* Almost the whole of this sample consisted of a bearded wheat with large, lax ears, smooth, red glumes, white grain and strong straw (var. *erythroleucon* Keke. Class XXXVI). There were

present as impurities in small quantity the two constituents of sample 1 and a bearded wheat with red, felted glumes and white grain (var. *turcicum* Kcke. Class XVI).

3. *Bajri from the village of Dhadpur.* One-third of this sample consisted of the same wheat as in 1, one-third of a bearded wheat with black awns, greyish white, felted chaff and red grain (var. *fuliginosum* Al. Class XX), one-sixth of a bearded wheat with smooth, white chaff and white grain (var. *graecum* Kcke. Class XLV), and one-sixth of a similar wheat with red grain (var. *erythrospermum* Kcke. Class XLII). There was also a small quantity of a bearded wheat with smooth, red glumes and red grain (var. *ferrugineum* Al. Class XXXII).

4. *Bajri from the village of Garhi Mir Muhamed.* Three-quarters of this sample consisted of a fully bearded wheat with lax ears, smooth, white glumes, dark red grain and weak, pink straw which turns black on ripening (var. *erythrospermum* Kcke. Class XLII). The rest of the sample was composed of a bearded wheat with white, felted glumes, strong straw and red grain (var. *Hostianum* Clem. Class XXI).

5. *Bajri from the village of Khudadad.* This was a very mixed sample, no less than nine wheats being present. About half the sample was composed of the bearded wheat with smooth, red glumes and white grain found in sample 2 (var. *erythroleucon* Kcke. Class XXXVI). The two main constituents of sample 1 formed each about one-fifth of the sample (var. *graecum* Kcke. Class XLV) and (var. *erythospermum* Kcke. Class XLII). There were also present in small quantity a bearded wheat with white, felted glumes and red grain (var. *Hostianum* Clem. Class XXI); a similar wheat with white grain (var. *meridionale* Kcke. Class XXVI); a bearded wheat with smooth, red glumes and red grain (var. *ferrugineum* Al. Class XXXII); a beardless wheat with red, felted glumes and white grain (var. *Delfii* Kcke. Class XLVIII); two beardless wheat with smooth, red glumes and white grain (var. *alborubrum* Kcke. Class LVIII and Class LIX); a beardless wheat with smooth, white glumes and white grain (var. *albidum* Al. Class LXII).

6. *Bajri from the village of Faizabad.* This resembled sample 5.

Sibi tahsil.

Two samples were received from this *tahsil*.

IV. Kahani or Bajri. This is a bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Kcke. Class XXXVI), similar to some of the

samples of *Bajra* from Nasrábád. There were also present as impurities in small quantity a similar wheat with red grain (var. *ferrugineum* Al. Class XXXII); a bearded wheat with red, densely felted chaff and white grain (var. *barbatum* Kcke. Class XV) and a beardless wheat with red, felted chaff and white grain (var. *Delfii* Kcke. Class XLVIII).

V. *Lal rôh.* This is a beardless wheat with red, felted glumes and white grain (var. *Delfii* Kcke. Class XLVIII). There were also present in small quantity a similar wheat with red grain (var. *pyrothrix* Al. Class XLVI) and a beardless wheat with smooth, red chaff and white grain (var. *alboruberum* Kcke. Class LVIII).

Kohda sub-tahsil.

Two samples were sent from this locality, one grown on irrigated and the other on unirrigated land. There is no distinctive name for this wheat.

VI. Sample A, grown on irrigated land. The sample was mainly composed of a bearded wheat with smooth, white glumes and red grain (var. *erythrospermum* Kcke. Class XLII). Two other wheats were present as impurities: a bearded wheat with smooth, white chaff and white grain (var. *graecum* Kcke. Class XLV) and a bearded wheat with smooth, dark red chaff and white grain (var. *erythroleucon* Kcke. Class XXXVIII).

VII. Sample B, grown on unirrigated land. This consisted of a mixture in equal parts of the main constituent of sample A and of a bearded wheat with smooth, bright red chaff and red grain (var. *ferrugineum* Al. Class XXXII.)

Shahrig tahsil.

Three samples were received from this *tahsil*.

VIII. Spin ghanam, lasidar, starchy white wheat or *Balu Ali*, sandy wheat. It is only grown on irrigated land. This sample was a mixture in equal parts of a rivet wheat and a common wheat. The rivet wheat had smooth, white glumes with a peculiar ridge on the outer glumes and large, plump, white grain (var. *nemausense* Wittm. Class III). The other constituent was a bearded wheat with smooth white chaff and red grain (var. *erythrospermum* Kcke. Class XLII).

IX. Spin ghanam, Be lasidar, white wheat without starch. This is a bearded wheat with short awns, very rounded, greyish-white, felted glumes and white grain. The straw is very strong almost solid (var. *murdochianum* Kcke. Class XXIX).

X. Soor ghanam, red wheat. This variety is grown both on irrigated and unirrigated land. The ears are bearded, the chaff smooth and white and the grain red (var. *erythrospermum* Keke. Class XLII). Two wheats were present in small quantities as impurities, a bearded wheat with red, felted glumes and white grain (var. *turcicum* Keke. Class XV) and a bearded wheat with smooth, red chaff and red grain (var. *ferrugineum* Al. Class XXXII).

BOLAN PASS.

This District includes the Bolán Pass proper and the lands occupied by the Mushkáf-Bolán and Quetta-Nushki Railways. It forms a long, narrow strip of country 60 miles long with a change in altitude from 163 feet at the southern end (Rindli) to 5,793 feet at the upper end (Dhast). The District is mountainous with long, narrow valleys and of the 900 square miles only a very small portion is cultivable.

The climate varies with the altitude ; the summer is extremely hot in the lower parts of the Pass and the winter very severe above Mach. A strong north wind blows constantly but is strongest in January. February and March causing damage to the wheat crop. The average rainfall in the upper part of the valley is 7·64 inches which falls mainly between December and March : at Panèrband, on the other hand, most of the rain falls in the summer months and the average annual rainfall is 4 inches. The cultivated area lies mainly in the lower two-thirds of the valley, in the valleys and flats between the mountains, and the rainfall at Panir represents that of these areas.

The irrigated land lies chiefly round Rindli, Kirta, Kundalam, Bíbi Nani, Píshi and in the bed of the river between Mach and Kolpur while the dry crop lands are principally at Takari, Toba, Panérband, Sàhibdàd Thal, Chirak and Zámuri. The Bolán River with its springs and the Mach hill torrent are the main sources of water. The irrigated area at Kirta is about 3,135 acres, at Rindli 27 acres and at Mach 7 acres while the dry crop area is about 800 acres.

The spring harvest on irrigated land which constitutes at about 58 per cent. of the whole cultivation consists mainly of wheat. No records of the outturn are available. The dry crop land is generally under wheat if the rainfall is sufficient. The time of sowing varies with the altitude. On irrigated land the seed is sown broadcast between October and December. It is either sown in the dry land and then watered or the land is watered first and then sown. If possible it is watered again as soon as it has

germinated and then at intervals of about twenty days. It is cropped in January for fodder and harvested in early May.

The following is the description given in the *Bolan Gazetteer* of the varieties grown:

"The wheat sown in the District is of seven varieties: *bárkhami* the seed of which, as the name implies, was originally imported from Bárkhán in the Loralai District about the year 1885; *talmalo*, a new variety imported from Narmuk about 1901, the grain of which is larger and thicker than that of *bárkhami*; *sahr-bij*, the indigenous variety; *réli*, a kind introduced from India since the opening of the railway; *sangsila* introduced from the Bugti country; *kárézi nâ bij*, also known as *pazhmi*, a white variety, the seed of which has been imported from Marav in Sarawán; and *wára*, a red wheat also said to be indigenous. *Wára* is an inferior sort and is now seldom cultivated. *Bárkhami* and *talmalo* are now (1905) most popular."

A very large number of samples were received from the Bolán but unfortunately none of them were labelled and it is therefore impossible to identify them with the varieties mentioned above. The samples were somewhat unlike the other Baluchistán wheats and seemed to form a separate group. Many had pink straw and very rounded glumes. The ears on the whole were thin and very lax.

The twenty-three samples received belonged to seven different types. (This refers only to the bulk of the sample and not to the wheats present as accidental impurities.)

Three samples belonged to var. *meridionale* Keke. Class XXVIII (ears partly bearded; glumes white, felted, rounded; grain white, short and very humped).

1. *Sample 1.* Five-sixths of the bundle belonged to the above class and there were present in small quantities, as accidental impurities, a fully bearded wheat with white, felted glumes, red grain and pink straw (var. *Hostianum* Clem. Class XXIII); a fully bearded wheat with smooth, white chaff, white grain and pink straw (var. *glaucum* Keke. Class XLV) and a partly bearded wheat with smooth red chaff and white grain (var. *erythroleucon* Keke. Class XXXIX).

2. *Sample 2.* Three-quarters of the bundle belonged to Class XXVIII and there were four other wheats present as impurities: a fully bearded wheat with white, felted glumes and red grain (var. *Hostianum* Clem. Class XXII); a fully bearded wheat with smooth, white chaff and red grain

(var. *erythrospermum* Kcke. Class XLIV) : a similar wheat with white grain (var. *graecum* Kcke. Class XLV) and one ear of a beardless wheat with smooth, red chaff and white grain (var. *alborubrum* Kcke. Class LX).

3. *Sample 3.* Three-quarters of the sample belonged to Class XXVIII and there were present in small quantity a fully bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXIII) : a fully bearded wheat with smooth, white chaff and white grain (var. *graecum* Kcke. Class XLV) and a similar wheat with red grain (var. *erythrospermum* Kcke. Class XLIV).

Nine samples (Nos. 4–12) belonged to var. *erythroleucon* Kcke. (bearded wheats with smooth, red glumes and white grain) and of these, three samples (4, 5 and 6) belonged to Class XXXVII (ears fully bearded, grain with distinct hump) and six belonged to Class XXXIX (ears partly bearded, grain without a hump).

4, 5. *Samples 4 and 5* were very nearly pure but in both samples there was a small quantity of a fully bearded wheat with smooth, red chaff and red grain (var. *ferrugineum* Al. Class XXXIII), and in sample 5 there were also small quantities of a fully bearded wheat with red, felted chaff and red grain (var. *barbarossa* Al. Class XIV), as well as of a fully bearded wheat with smooth, white chaff and white grain (var. *graecum* Kcke. Class XLV).

6. In *Sample 6*, three-quarters of the sample belonged to Class XXXVII, and the following wheats were present in small quantities : a bearded wheat with white, felted glumes, white awns and red grain (var. *Hostianum* Clem. Class XXIII) : a bearded wheat, with smooth white glumes and red grain (var. *erythrospermum* Kcke. Class XLIV) : a bearded wheat with smooth, white glumes and white grain (var. *graecum* Kcke. Class XLV) : a beardless wheat with red, felted glumes and white grain (var. *Delfii* Kcke. Class XLVIII) ; a beardless wheat with white, felted glumes and red grain (var. *celatinum* Schübl. Class LII) : a beardless wheat with felted, white glumes and white grain (var. *leucospermum* Kcke. Class LIV), and the same wheat belonging to var. *ferrugineum* Al. Class XXXIII, which was present in samples 4 and 5.

7, 8, 9. In the samples belonging to Class XXXIX, sample 9 was quite pure and samples 7 and 8 practically so, only single ears of a partly bearded wheat with smooth, red glumes and red grain (var. *ferrugineum* Al. Class XXXV) being found in them.

10. In *Sample 10*, seven-eighths belonged to Class XXXIX and the following wheats were present in small quantities : a wheat similar to samples

4, 5 and 6; a bearded wheat with red, felted glumes and red grain (var. *barbarossa* Al. Class XIII); a similar wheat with white grain (var. *tarcicum* Keke. Class XVII) and the same wheat belonging to var. *ferrugineum* Al. Class XXXV which was present in samples 7 and 8.

11. *Sample 11* was almost pure but a few ears of the following were present: a bearded wheat with smooth, red glumes and red grain (var. *ferrugineum* Al. Class XXXIV); a partly bearded wheat with felted, red chaff and white grain (var. *tarcicum* Keke. Class XVII); a fully bearded wheat with white, felted chaff and white grain (var. *meridionale* Keke. Class XXVII), and a partly bearded wheat with white, felted chaff and white grain (var. *meridionale* Keke. Class XXX).

12. In *Sample 12* seven-eighths of the bundle belonged to the type and the following wheats were present in small quantities: a wheat similar to samples 4, 5 and 6, a partly bearded wheat with smooth, red glumes and white grain (var. *ferrugineum* Al. Class XXXIV); a fully bearded wheat with white, smooth chaff and white grain (var. *graecum* Keke. Class XLV); a similar wheat with red grain (var. *erythrospermum* Keke. Class XLIV); a fully bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXII), and a partly bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXIV).

Three samples belonged to var. *erythrospermum* Keke. Class XLIV (ears bearded, long and lax; chaff smooth, white; grain red). All the three samples were very mixed and less than half belonged to the type.

13. In *Sample 13*, about half was true to type, and about one-quarter consisted of a somewhat similar wheat but with white grain, strong straw and lax, bold heads (var. *graecum* Keke. Class XLV). There were also present in fair quantity: a fully bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXII) and the wheat of which samples 4, 5 and 6 consisted. A very small quantity of a fully bearded wheat with red, smooth chaff and red grain (var. *ferrugineum* Al. Class XXXIII) was also found.

14. In *Sample 14*, only one-third of the sample resembled the type, while one-quarter consisted, as in sample 13, of a somewhat similar wheat with white grain, stronger straw and larger ears (var. *graecum* Keke. Class XLV). The same three impurities occurred in this sample as in sample 12 and in addition a small quantity of a fully bearded wheat with white, felted chaff and white grain (var. *meridionale* Keke. Class XXVII).

15. *Sample 15* consisted of three wheats in about equal quantities: the bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLIV) which formed the bulk of samples 13 and 14: the somewhat similar wheat with white grain, stronger straw and larger ears (var. *graecum* Kcke. Class XLV), which formed the chief impurity in these samples, and a partly bearded wheat with white, felted chaff and white grain (var. *meridionale* Kcke. Class XXVIII). There was also present in very small quantity a fully bearded wheat with felted, white chaff and red grain (var. *Hostianum* Clem. Class XXII).

Two samples 16 and 17 belonged to var. *Delfii* Kcke. Class XLIX (beardless wheats with short, dense ears; felted, red glumes and white grain).

16. Seven-eighths of *Sample 16* resembled the type: the remainder consisted mostly of a similar wheat with red grain (var. *pyrothrix* Al. Class XLVII). There were also present in small quantity two beardless wheats with smooth, red chaff; one with red grain (var. *milturum* Al. Class LVI) and the other with white grain (var. *alborubrum* Kcke. Class LVIII).

17. *Sample 17* was very mixed and contained no less than nine distinct wheats. One-third of the bundle resembled the type, one-quarter the main impurity of sample 16 and one-quarter consisted of a beardless wheat with smooth, red chaff and white grain (var. *alborubrum* Kcke. Class LVIII). There were also present in small quantity the following wheats: a bearded wheat with smooth, red chaff and red grain (var. *milturum* Al. Class LVI); a beardless wheat with smooth, white chaff and white grain (var. *albidum* Al. Class LXII): a beardless wheat with white, felted chaff and white grain (var. *leucospermum* Kcke. Class LIV): a similar wheat with red grain (var. *velutinum* Schübl. Class LII), and two bearded wheats (one fully bearded and one partly bearded) with smooth, red chaff and white grain (var. *erythroleucon* Kcke. Classes XXXVII and XXXIX).

18, 19, 20, 21. Four samples consisted mainly of a beardless wheat with white, felted chaff, white grain and pink straw (var. *leucospermum* Kcke. Class LIV). Seven-eighths of the samples 18 and 19 consisted of this type and nine-tenths of the samples 20 and 21 but only one-third of sample 21 which was very mixed. The following wheats were present as impurities in all five samples: a beardless wheat with felted, white glumes and red grain (var. *velutinum* Schübl. Class LII): a beardless wheat with smooth, white

chaff and white grain (var. *albidum* Al. Class LXII); a beardless wheat with smooth, red chaff and white grain (var. *alboaduum* Keke. Class LX). In samples 19 and 22 there was also present a beardless wheat with felted, red glumes and red grain (var. *pyrothrix* Al. Class XLVII). A beardless wheat with smooth, red glumes and white grain (var. *alboaduum* Keke. Class LVIII) was present only in sample 20.

22. *Sample 22* which was very mixed contained in addition to the above impurities two wheats, a beardless wheat with red, felted glumes and white grain (var. *Delfii* Keke. Class XLVIII) and a bearded wheat with smooth, white glumes and red grain (var. *erythrospermum* Keke. Class XLIV).

23. *Sample 23* was exceedingly mixed and it was difficult to know which was the main constituent. One sixth of the sample consisted of a beardless wheat with smooth, white chaff and white grain (var. *albidum* Al. Class LXII); one-sixth consisted of a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLIV); one-sixth consisted of a beardless wheat with white, felted chaff and white grain (var. *leucospermum* Keke. Class LIV). There were also present, in fair quantity, a similar wheat with red grain (var. *velutinum* Schübl. Class LII); a fully bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXIII) and a beardless wheat with smooth, white chaff and red grain (var. *lutescens* Al. Class LX); in small quantity a beardless wheat with felted, red chaff and red grain (var. *pyrothrix* Al. Class XLVII) and a similar wheat with white grain (var. *Delfii* Keke. Class XLVIII).

QUETTA-PISHIN.

The Quetta-Pishin District is one of the best irrigated Districts in Baluchistán and has therefore the largest cultivated area. It lies centrally in the highland part of Baluchistán with an area of 5,127 square miles. The general character of the District is mountainous with long, narrow valleys. All the valleys are flat plains, 4 to 20 miles in width, with pebbly slopes rising to the mountains. The Pishín plain is the largest of the valleys and others of importance are Loé Toba, the Quetta valley, the Aghbarg valley, and the Gwál valley.

Generally speaking, the climate is fairly uniform over the whole District but varies somewhat with the altitude. In Toba, the seasons begin a month later than in Quetta while Pishín and Chaman are decidedly warmer. The winter is very cold, with snow and biting cold winds, while the summer is hot

at Chaman and Pishín, moderately hot at Quetta and cool at Toba. The average temperatures of Chaman and Quetta are shown in the following table :—

		January		May		July		November	
Station.	*Altitude.*	*Mean.*	*Diurnal range.*	*Mean.*	*Diurnal range.*	*Mean.*	*Diurnal range.*	*Mean.*	*Diurnal range.*
Chaman	4,511	43·9	18·1	79·6	27·4	88·3	26·6	57·6	24·5
Quetta	5,502	40·0	24·8	67·8	31·4	78·7	27·9	48·7	32·7

The temperatures of Pishín lie between those of Chaman and Quetta.

The rainfall is irregular and occurs mostly in the winter. It is due to storms from the Persian plateau and may consist of either rain or snow. Most of the rain and snow falls in January and February but the storms vary in number and period from year to year. It is more important that there should be good snow than good rain as the rain runs off the slopes very quickly in the form of floods and does not benefit the *kárézes*, springs and streams as much as the snow. Moreover, the vapour tension of snow being lower than that of water, the snow protects the land from drying. The average annual rainfall in Quetta is 10·52 inches, in Pishín 8·69, and in Chaman just over 7 inches.

The whole District is very liable to strong winds. Chaman was reported to have calm weather at 8 A.M. on only twelve days in the whole year.

There are two rivers with many tributaries, the Kadanai which drains the Toba plateau and flows into Afghánistán and the Pishín Lora which, with its tributaries, waters the remainder of the District and passes into Chágai. The water of the main stream of the Kadanai is salt and is said to be injurious to crops. It is, however, raised by earthen dams in some parts and used for irrigation purposes. The Táshrobát, a tributary of the Kadanai, with its own tributaries the Jilja, Hésanna, Gwál, and Zémal supplies most of the water for the irrigated area on the Toba plateau. This consists of patches along the banks of streams on the skirts of the hills.

In the Chaman Subdivision the main cultivated tracts are Loé Toba, Tabina and the Sahara, the plain round the town of Chaman. Most of this is dry crop cultivation, but there are patches of irrigated cultivation near springs and streams and in ravines. In Pishín there are large dry crop areas in the level plain itself and tracts of land irrigated by the Government canal at Shélabo and the Kushdil Khán Reservoir and by *kárézes*, springs and streams. In the Barshor tract, where water is abundant, most of the cultivation is carried out on terraced fields. In the Quetta *tahsíl*, both dry crop cultivation and irrigation from *kárézes*, springs and streams are found. In 1902-03 in the two *tahsíls* of Quetta and Pishín, the irrigated area represented 31 per cent. of

the total cultivable area and 68 per cent. of the area actually cultivated (2,07,317 acres).

Wheat is the most important crop grown and forms almost the whole of the spring harvest. The method of growing it as a dry crop varies in the different parts of the District. In Quetta, the lands are embanked and are filled with flood water when available, either in late summer or in winter. The land is then ploughed and sown. Good summer rain is necessary to fill the embankments, if a satisfactory yield is to be obtained; later sowing results both in a diminished yield and in a smaller proportion of straw. In Pishín and Toba, the land is not embanked and sowing only takes place after rain. In some parts of Quetta and Pishín, the land is prepared in September and October, the seed sown in the dry ground and left until the next rain causes it to germinate. In all cases, the yield on dry crop lands depends on good spring rains. Dry crop lands are not manured and are generally cultivated every year. The yield is about five maunds an acre. Sowing for dry crop wheat may be continued into the spring, especially in Toba.

Irrigated lands are usually only cultivated every second or third year. This is probably connected with the aeration of the land. Under the system of continual watering in vogue, the land becomes very compacted, and no aeration is possible. Dry crop land, on the other hand, which is not irrigated and in which aeration can take place is cultivated every year. In the neighbourhood of Quetta, the wheat land is generally heavily manured. The irrigated land is ploughed twice during the fallow, once in the spring and once in June. It is watered in September: the seed is sown broadcast and then ploughed in. The first watering takes place forty days after sowing, the second about the last week in December, and the third at the end of February. The fourth watering is not given till the middle of April and after this the crop is watered regularly at intervals of ten to fifteen days. Harvest takes place in June and July according to the locality. The yield on irrigated, manured land varies from 15 to 25 maunds and in irrigated, unmanured land from 10 to 16 maunds per acre.

The following account of the varieties of wheat grown is given in the Quetta-Pishín *Gazetteer*:—

"The wheat grown in the District is of two kinds, called respectively *da sára ghanam* and *da tanda ghanam*; each kind in its turn consists of a white and red variety, locally known as *spín* and *sár ghanam*. The seed of the *sára spín ghanam* (winter white wheat) is said to have been originally imported from Garmsél in Afghánistán, while the red variety is said to be indigenous

to Quetta. The seed of the *tauda* (summer or hot) wheat, both white and red, was imported from Shoráwak in Afghánistán : hence it is also called *shoráwaki ghanam*. For their own consumption, the people prefer the red wheat, but the white is much grown because it fetches the best price of all. Winter (*sára*) wheat ripens in about nine months and *tauda* in a little more than half that period."

Eighteen samples of wheat were received from the Quetta-Pishín District, eight from the Quetta Sub-division, seven from the Chaman Sub-division, and three from Pishín.

Quetta Sub-division.

1. *Pambarin*, a white wheat with a white spike. This wheat is said to be grown both on irrigated land and as a dry crop. Some of the crop is used for food and the rest sold. As a rule, the cultivators prefer a red-grained wheat for their own use but white wheats fetch a higher price. This is a bearded wheat with very rounded, white, densely felted glumes with white grain (var. *meridionale* Ecke. Class XXVIII). There was also present as an impurity a similar wheat with red grain (var. *Hostianum* Clem. Class XXIII) and one ear of a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Ecke. Class XLII).

The above sample was from irrigated land : another sample was sent from *khushkába* land which was not so pure. One-third of the bundle was the true *Pambarin* wheat, one-third consisted of a bearded wheat with smooth, white chaff and white grain (var. *graecum* Ecke. Class XLV), and the rest was composed of the two wheats present as impurities above.

2. *Pambarin*, a white wheat with a red spike. This is also grown both on irrigated and dry crop lands. It is a wheat with short awns and small heads, smooth, reddish brown chaff and white grain (var. *erythroleucon* Ecke. Class XXXIX). About one-fifth of the sample consisted of a somewhat similar wheat but with fully bearded ears and larger grain (var. *erythroleucon* Ecke. Class XXXVIII). There was also present in small quantity a wheat similar to the type but with red grain (var. *ferrugineum* Al. Class XXXIV).

3. *Surbaj*. This is a cheaper wheat than either of the two *Pambarins* and the whole is used by the *zamindars* as food. It is grown on irrigated land. It is a bearded wheat with very lax, bold heads and spreading awns, white, smooth chaff, red grain and very strong straw (var. *erythrospermum* Ecke. Class XL). There were no impurities in this sample.

4. *Toda*. A red wheat with a white spike from Shoráwak. Both this and the white *Toda* (sample 5) mature with very little water, and if there are no early rains and cultivation is done late in the season, then about five-sixths of the whole *khashkába* area is put under these two wheats. This is a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLII). There were also present as impurities a similar wheat with white grain, the white *Toda* (var. *graecum* Keke. Class XLV) and a bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Keke. Class XXXVIII).

5. *Toda*. A white wheat with a white spike from Shoráwak. This is similar to the red Toda but has a white grain (var. *graecum* Keke. Class XLV). There were also present as impurities in small quantity: some red Toda; a bearded wheat with black awns, white, felted chaff and red grain (var. *fuligenosum* Al. Class XIX); a bearded wheat with white, densely felted chaff and white grain (var. *meridionale* Keke. Class XXVI) and a similar wheat with red grain (var. *Hostianum* Clem. Class XXI).

6. *Shatr damdan* (shaped like a camel's tooth). This is very rarely grown and always only in very small quantity on irrigated land. It is not ground into flour but is parched and chewed. No sample was sent so that no identification was possible.

Both *Pambarins* and *Surbaj* are said to be more liable to rust than the two *Toda* wheats, but whether this is really true or whether it is due to the fact that rust is generally less on the *khashkába* lands on which the *Toda* wheats are grown it is difficult to say.

Two other unnamed samples were received from Quetta. They resembled in every particular *spín* wheat from Pishín.

7. *Unnamed sample, probably spín wheat*. Three-quarters of the bundle consisted of a wheat with lax ears, short awns, rounded glumes and white grain (var. *meridionale* Keke. Class XXVIII). Nearly a quarter of the sample consisted of the fully bearded, smooth, red chaffed wheat with red grain (var. *erythrospermum* Keke. Class XLIV). There were also present in very small quantity a wheat similar to the last but with white chaff and white grain (var. *graecum* Keke. Class XLV); a bearded wheat with felted, white chaff and red grain (var. *Hostianum* Clem. Class XXIII), and a fully bearded wheat with smooth, red chaff and white grain (var. *meridionale* Keke. Class XXXVII).

8. *An unnamed sample probably spín*. Three-quarters of the sample resembled *spín* wheat from Pishín (var. *meridionale* Keke. Class XXVIII)

and there were present as impurities : a fully bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXIII) ; a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLII), and a similar wheat with white grain (var. *graecum* Kcke. Class XLV).

Chaman Sub-division.

9. *Kali ghanam.* This is grown on irrigated land and is said to be rarely attacked by rust. It is a common wheat with square heads and much rounded glumes. The chaff is white and felted and the grain white. The bearding was difficult to determine. There appeared to be every stage between almost beardless ears to bearded (var. *meridionale* Kcke. Class XXVIII). There were also present as impurities a similar wheat with red grain (var. *Hostianum* Clem. Class XXI) and a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLI).

10. *Kamar* (white and red seed mixed). This is also grown on irrigated land. Most of the sample consisted of a bearded wheat with sharply keeled glumes, white, densely felted chaff and white grain (var. *meridionale* Kcke. Class XXVI). There was also present a fair quantity of a similar wheat but very slightly bearded and with very rounded glumes (var. *meridionale* Kcke. Class XXVIII). Other impurities were : a bearded wheat with short awns, white, felted chaff and red grain (var. *fuliginosum* Al. Class XVIII) ; a bearded wheat with smooth, white glumes and red grain (var. *erythrospermum* Kcke. Class XLII) ; a similar wheat with white grain (var. *graecum* Kcke. Class XLV), and a slightly bearded wheat with rounded, white, densely felted glumes and red grain (var. *Hostianum* Clem. Class XXV). It will be seen that though the sample was labelled white and red grain the number of red grained ears was very small and did not form more than 5 per cent. of the whole. *Kamar* wheat is said to be rarely attacked by rust.

11. *Surmani.* This wheat is grown mostly in Toba on both irrigated and unirrigated land. It is said to be very liable to rust. Three-quarters of the sample consisted of a bearded wheat with small ears, smooth, white chaff, white grain and weak straw (var. *graecum* Kcke. Class XLV). The rest of the sample consisted of a similar wheat with red grain (var. *erythrospermum* Kcke. Class XLII).

12. *Khosha* is grown both on irrigated and unirrigated land and is fairly rust-resistant. It is a bearded wheat with smooth, white chaff and red grain

(var. *erythrospermum* Keke. Class XLII). There were no impurities in this sample.

13. *Godewoda*. This kind is grown only on irrigated land and is said to be very liable to rust. It is difficult to know which of the constituents of this sample is the real *godewoda*. About half the ears resembled the sample of *Kali ghanum* (var. *meridionale* Keke. Class XXVIII) and about half consisted of a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLII). There were also present in very small quantity a fully bearded wheat with white, felted glumes and red grain (var. *Hostianum* Clem. Class XXIII) and a bearded wheat with smooth, white chaff and white grain (var. *graecum* Keke. Class XLV).

14. *Spin ghanum*. This kind is only grown on irrigated land and is fairly rust-resistant. It is a slightly bearded wheat with white, densely felted chaff, white grain and very rounded glumes. The straw is fairly strong (var. *meridionale* Keke. Class XXVIII). There were also present as impurities a fully bearded wheat with white, densely felted chaff and white grain (var. *meridionale* Keke. Class XXVI); a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLI) and a bearded wheat with smooth, white chaff and white grain (var. *graecum* Keke. Class XLV).

15. *Khushkába ghanum*, wheat from unirrigated land. This sample consisted mainly of a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLII). There were also present a similar wheat with red grain (var. *ferrugineum* Al. Class XXXIII) and a bearded wheat with smooth, white chaff and white grain (var. *graecum* Keke. Class XLV.)

Pishin tahsil.

16. *Spin* (white wheat). This kind is grown on irrigated land. The grain is used as food by the wealthy classes or is sold. This sample was very mixed, about one-half consisted of a wheat with medium to lax ears, very short awns, rounded glumes, white humped grain and strong straw (var. *meridionale* Keke. Class XXVIII). There was also a fair quantity of a very similar wheat but with longer awns, weak straw and sharply keeled glumes (var. *meridionale* Keke. Class XXVII). A large part of the sample (about one-third) consisted of a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLIV). There were also present as impurities but in small quantity a wheat similar to the last but

with white grain (var. *graecum* Keke. Class XLV) ; a fully bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Keke. Class XXVIII) : a similar wheat with red grain (var. *ferrugineum* Al. Class XXXIII), and a wheat with partly bearded ears, rounded glumes, felted, white chaff and red grain (var. *Hostianum* Clem. Class XXIII).

17. *Kamar* (white and red). This is also grown on irrigated land. The sample consisted of a mixture in almost equal parts of a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLIV) and a white wheat exactly like the main constituent of *Spín*. There was also present in fair quantity the wheat resembling *Spín* but with longer awns and sharply keeled glumes (var. *meridionale* Keke. Class XXVII). Thus the samples of *Kamar* and *Spín* contained the same three constituents but in varying proportions. There were also present as impurities in small quantity : a fully bearded wheat with smooth, white chaff and white grain (var. *graecum* Keke. Class XLV) ; a fully bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXIII) ; a fully bearded wheat with red, smooth chaff and white grain (var. *erythroleucon* Keke. Class XXXVII), and a similar wheat with red grain (var. *ferrugineum* Al. Class XXXV).

18. *Sára*. This is grown on *khushkába* land only and is used by the poorer people. It is the fully bearded wheat with smooth chaff, red grain and weak, pink straw (var. *erythrospermum* Keke. Class XLIV), which forms one of the constituents of both *spín* and *kamar*. There were also present as impurities in small quantity a similar wheat with white grain (var. *graecum* Keke. Class XLV) ; a bearded wheat with smooth, red glumes and red grain (var. *ferrugineum* Al. Class XXXIII), and a fully bearded wheat with felted glumes and round, red grain (var. *Hostianum* Clem. Class XXIII).

A sample of wheat labelled *Madar khushkába* was received from an unknown district. This resembled the *spín* wheat of Pishín so closely that it is probable it came from the Quetta-Pishín District.

19. *Madar khushkába*. Three-quarters of the sample consisted of *spín* wheat (var. *meridionale* Keke. Class XXVIII), and there were present in fair quantity a somewhat similar wheat but fully bearded and without rounded glumes (var. *meridionale* Keke. Class XXVI) and a fully bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLII). There were also present in small quantity a fully bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Keke. Class XXXVIII) ; a fully bearded wheat with smooth, white chaff and white

grain (var. *graecum* Keke. Class XLV), and a fully bearded wheat with red chaff and white grain (var. *ferrugineum* Al. Class XXXV).

LORALAI.

Loralai is a crescent shaped District bounded on the north by Zhob, on the west by Sibi, and on the east by Déra Gházi Khán and Déra Ismáil Khan. The District has an area of 7,999 square miles. It is mountainous with long, narrow valleys between the mountain ranges. The chief valleys are the Bori valley on the north which runs east and west with a length of 80 miles and a breadth of only 8 miles, the Sahra which lies in the north-east, the Bárkhán valley in the south-east and the Karcha valley between the Bárkhán valley and Déra Gházi Khán. In the south-western and central portions of the District, lie a series of plains of which the most important is Thal Chotiáli which is so level and flat that it is said to have the appearance of an inland sea.

The climate varies with the altitude. In the west, the summer is cool and the winter intensely cold, while in the south and east the heat in summer is great and the temperature generally is more uniform.

There is no monsoon and the rainfall is small, 8·21 inches at Loralai and 6·75 at Duki, but in contrast with the greater part of Baluchistán the greatest rainfall occurs in the summer, except on the west.

As in Zhob, there are many rivers of which the Anambár and its tributaries are the largest. Many of the streams are used for irrigation. Springs and *kárézes* are also common, the former occur mostly in Sanjáwi *tahsíl*, the latter in Bori. Dry crop cultivation is carried on both by flood irrigation in embanked fields and on rainfall only. The most important flood streams are the Anambár and Thal streams in the Duki *tahsíl*.

The following estimate was made in 1904-05 of the area under these various forms of irrigation :—

	Percentage of cultivated area				
	Bori	Sanjawi	Duki	Musa Khel	Barkhán
Permanent irrigation ...	75	29	45	35	11
Flood irrigation ...	...	70	55	65	79
Pure rain cultivation ...	25	1	...	...	10

Wheat is the most important crop in the District : in Sanjáwi 2,230 acres out of 4,115 acres cultivated were in wheat, in Bori 11,003 acres out of 15,434

Two methods of cultivating wheat on irrigated land are practised. In the first case, the land is ploughed during the spring and summer after rain, the land is manured in October, and the seed sown broadcast in dry land, which is then ploughed, levelled and irrigated. In other parts of the District, such as Sanjáwi and Duki, the land is watered before sowing and the seed sown by drill. The land destined for wheat is generally well prepared, as much as ten ploughings being given in the Músa Khél *tahsíl*. The amount of irrigation given depends on the locality. The second watering is given a fortnight after germination. During the two winter months, no irrigation is required except in Bárkhán, the third watering being given about the middle of March. In Sanjáwi, water is required every seven to ten days, in Bori twice a month, and in the rest of the District every fifteen or twenty days. In Bárkhán, wheat is watered throughout the winter twice a month. During the winter, the wheat crop is cropped by goats and sheep. The time of sowing and of harvesting varies in the different *tahsíls*. It is earliest in Sanjáwi and Bárkhán.

In dry crop cultivation, the embanked fields are filled with water, ploughed and smoothed in August and September. In some parts of Músa Khél the land is manured. The seed is generally sown by drill but if moisture is abundant it is sometimes sown broadcast.

Wheat is sometimes affected by cold winds in the spring, by white ants in times of drought, by rust and by the rice-stem caterpillar which attacks the roots if too much flood water is used.

The following is the average outturn of wheat in the District :-

	In maunds per acre				
	Sanjáwi	Bori	Duki	Músa Khél	Bárkhán
Irrigated and manured land	23	15·18	23	12	25
Land irrigated but unmanured	20	10·12	20	8	20
Sailaba	15	...	18	...	25
Khushkaba	14	3·9	15	6	15

The following account of the varieties of wheats grown in the Province is taken from the Loralai *Gazetteer* :

"Several kinds of wheat are grown in the District, the most common ones being the *spín ghanam* or white, and *sra ghanam* or red wheat ; the former is cultivated in *khushkába* and the latter in irrigated land. Besides these two varieties, two others are known in Músa Khél, the *kundi ghanam* and *málav ghanam*, the seed of the former having been imported from the Dáman in the Déraját. The seed of the *málav ghanam* is said to have been imported

from the Kohát District in the North-West Frontier Province and is cultivated in irrigated lands in the Gargoji, Nath and Ganbar villages of the Drug circle."

Sixteen samples were received from the Loralai District.

Daki tahsil.

1. *Spín ghanam*, white wheat. Very little of this variety is grown and most of it is sold. It is grown both on irrigated and dry crop land and is said to be more rust-resistant than the red wheat. It is a bearded wheat with weak straw, smooth, white chaff and white grain (var. *graecum* Keke. Class XLV). About half the sample consisted of a similar wheat with red grain (var. *erythrospermúm* Keke. Class XLI).

2. *Sára ghanam*. This is the main variety of the *tahsil*. It is very liable to rust. It is a bearded wheat with smooth, light red chaff and red grain (var. *ferrugineum* Al. Class XXXII). There was also present a large amount of a similar wheat with a white grain (var. *erythrolaeum* Keke. Class XXXVI); and a small amount of a bearded wheat with red, felted chaff and white grain (var. *turcicum* Keke. Class XV).

3. *Wadának*. This wheat was introduced from the Punjab and was only grown on a small scale as an experiment. It is the ordinary *Wadának* of the Punjab (Punjab Type 1), a macaroni wheat with black awns, white, felted glumes and white grain (var. *melanopus* Al. Class V).

Sanjáni tahsil.

4. *Spín ghanam*, white wheat. About one-third of the wheat cultivated belongs to this variety. It is grown both on irrigated and unirrigated land. It is a strong-strawed, fully bearded wheat with smooth, bright red chaff and white grain (var. *erythrolaeum* Keke. Class XXXVI). There was also present a large quantity of a similar wheat with red grain (var. *ferrugineum* Al. Class XXXII), a fair quantity of a bearded wheat with short, square ears, red, densely felted chaff and white grain (var. *turcicum* Keke. Class XV) and a very small quantity of a similar wheat with red grain (var. *barbarossa* Al. Class XIII).

5. *Sára ghanam*, red wheat. This is the chief wheat of the tract and is grown on all kinds of land. It is a fully bearded wheat with thin ears, weak straw, smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLI). There was also present in large quantity a similar wheat with stronger straw and white grain (var. *graecum* Keke. Class XLV), in smaller quantity a bearded wheat with white, densely felted chaff and red grain

(var. *Hostianum* Clem. Class XXI) and a similar wheat with red grain (var. *meridionale* Kcke. Class XXVI).

Bori tahsíl.

6. *Laghar or spín ghanam.* This variety is only cultivated to a small extent. The ears are lax with very rounded glumes and short awns, often black. The chaff is densely felted and white and the grain is white (var. *meridionale* Kcke. Class XXX). There were also present a bearded wheat with white, felted chaff with red grain (var. *fuliginosum* Al. Class XIX): a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLI) and a bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Kcke. Class XXXVIII).

7. *Spín ghanam.* About two-thirds of the area in wheat is under this variety. It is very rust-liable and is grown both on irrigated and unirrigated land. The ears are short, bearded with black awns: the glumes are densely felted, dark red and sometimes blackened. The grain is white (var. *turcicum* Kcke. Class XV). There was also present in very small quantity a similar wheat with light red grain (var. *barbarossa* Al. Class XIII). In addition, two other wheats occurred in fair quantity: a bearded wheat with smooth, light red chaff and white grain (var. *erythroleucon* Kcke. Class XXXVIII) and a similar wheat with red grain (var. *ferrugineum* Al. Class XXXII).

8. *Sára ghanam.* This variety covers about one-third of the area under wheat. It is more rust-resistant than *spín ghanam* but less so than *laghar*. The sample was a very mixed one. The largest portion consisted of a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLI). There were also present in fair quantity a wheat with short awns, rounded glumes, white, felted chaff and red grain (var. *fuliginosum* Al. Class XVIII): a bearded wheat with smooth, white chaff and white grain (var. *graecum* Kcke. Class XLV): a bearded wheat with smooth, white chaff, rounded glumes and red grain (var. *erythrospermum* Kcke. Class XLII) and in small quantity: a bearded wheat with smooth, red chaff and red grain (var. *ferrugineum* Al. Class XXXII): a similar wheat with dark red chaff and white grain (var. *erythroleucon* Kcke. Class XXXVIII): a bearded wheat with black awns, densely felted, white chaff and white grain (var. *meridionale* Kcke. Class XXVI); a similar wheat with red grain (var. *fuliginosum* Al. Class XX) and a slightly bearded wheat with felted, white chaff, rounded glumes and white grain (var. *meridionale* Kcke. Class XXX).

Bárkhán tahsíl.

9. *Lakhi.* This is the prevailing wheat in this *tahsíl*. It is grown on both unirrigated and irrigated lands and is somewhat rust-liable. The ears are bearded, the chaff smooth and white and the grain red (var. *erythrospermum* Keke. Class XLI). There were also present as impurities in small quantities a similar wheat with white grain (var. *graecum* Keke. Class XLV); a bearded wheat with square ears, densely felted, white chaff and red grain (var. *Hostianum* Clem. Class XXI); a bearded wheat with smooth, red chaff and white grain (var. *erythrolevcon* Keke. Class XXXVIII) and a similar wheat with red grain (var. *ferrugineum* Al. Class XXXII).

10. *Dholi.* This variety is not much cultivated but can be grown on both irrigated and unirrigated land. It is a bearded wheat with smooth, white chaff, white grain and rather weak straw (var. *graecum* Keke. Class XLV). There were no admixtures.

11. *Rodi.*[1] Unlike the first two varieties *Rodi* can only be grown on irrigated land. It is sparingly cultivated. The ears are bearded, the chaff smooth and brownish red and the grain white (var. *erythrolevcon* Keke. Class XXXVIII). There were also present as impurities a similar wheat with red grain (var. *ferrugineum* Al. Class XXXII) and a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLI).

Músa Khél tahsíl.

12. *Kundai.* This variety is grown on light, unirrigated land. It is, however, only cultivated to a small extent. It is a beardless wheat, with dense, club-topped ears, smooth, white chaff and white grain (var. *album* Al. Class LXIV). Only one impurity was present a similar wheat with red grain (var. *alborubrum* Keke. Class LXI).

13. *Urbsen.* Like *Kundai*, this variety is only grown on unirrigated land but the cultivation is general. The ears are bearded with smooth, red chaff and white grain (var. *erythrolevcon* Keke. Class XXXVIII). There were also present a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLI); a bearded wheat with white, felted glumes and red grain (var. *fuliginosum* Al. Class XX); a beardless wheat with smooth, white glumes and red grain (var. *alborubrum* Keke. Class LXI).

14. *Malán ghazbiza.* This is a macaroni wheat and is always grown on irrigated land as it requires a plentiful supply of water. The awns

[1] *Rodi* means a perennial river.

are black, the chaff white and densely felted, and the grain white (var. *melanopus* Al.).

15. *Zizha.* This wheat is said to be only sparingly grown and always on irrigated land. The ears are bearded with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLI). There were also present as admixtures a similar wheat with white grain (var. *graecum* Keke. Class XLV) and a bearded wheat with densely felted, white chaff and red grain (var. *Hostianum* Clem. Class XXI).

ZHOB.

The Zhob District lies in the north-eastern corner of Baluchistán. The greatest length is from east to west (160 miles) and the total area is 9,626 square miles. The greater part of the District is covered with mountain ranges intersected by valleys. In the south lies the great valley of the Zhob, an immense stretch of alluvial plain and in the north lies the valley of the Kundar and its tributaries. There are also numerous smaller valleys.

The climate varies with the altitude. In Upper Zhob and in the highlands generally, the summer is cool and the winter cold, while in Lower Zhob the summer is unpleasantly hot. The rainfall varies in different parts of the District, ranging from 10 inches in Fort Sandeman to about 4 inches in Kila Saifulla and 5 inches at Hindubágh. As in most other parts of Baluchistán, the largest rainfall occurs in the winter months especially in March. Strong winds are common but their direction varies with the season.

There are a very large number of rivers in the District, both perennial rivers and hill torrents. Most of the rivers run from west to east. The two most important are the Zhob and the Kundar with their tributaries. The water in the upper part of the Zhob river cannot be used for irrigation on account of the high banks but lower down dams are thrown across the stream and the water is taken off in open channels for irrigation purposes. This is the method adopted to raise the water in all the permanent streams and in some cases the water is raised to great heights on to terraced fields.

The following estimate of the irrigation facilities and the area watered by them was made in 1904-05:—

	Hindubágh		Kila Saifulla		Fort Sandeman
	Number	*Area*	*Number*	*Area*	*Number*
Streams	5	9,259	10	671	11
Springs	279	2,755	52	948	106
Karézes	71	5,887	52	19,915	...
Khushkaba	...	525	...	199	...

The largest amount of dry crop cultivation is situated in the Kila Saifulla *tahsil*, the area in the Fort Sandeman *tahsil* being comparatively small.

Wheat is the most important crop in the District and in the Kila Saifulla *tahsil* four fifths of the cultivated area (10,000 acres) was under wheat. The land is ploughed in the spring and watered in September. The seed is sown broadcast and the land is then ploughed. In some parts it is levelled, in others no levelling is ordinarily done. In Fort Sandeman where water is scarce, the seed is sown broadcast in dry land which is then ploughed and levelled and watered later. After germination has taken place, the wheat is ordinarily watered forty days after sowing and again after ten or twelve days. No further irrigation is given for about two months on account of the January and February rains. Generally three more waterings, at intervals of fifteen to twenty-five days are given from March onwards. Wheat is often grazed by animals in February and March.

In dry crop cultivation, the fields are embanked and filled during the summer with rain or flood water if possible. They are then ploughed in August or September and left smooth. Sowing may be carried out at any time from October to the end of March depending on the rainfall. In Hindubágh, the seed is sown broadcast and is then ploughed in and covered. In other parts, the land may be first prepared and then sown by drill.

Manure is generally used in irrigated land except in very fertile land or in places where land is left fallow for long periods, owing to the scarcity of the water-supply. Dry crop lands are cultivated every year while some of the irrigated land is left fallow for several years. Only 271 acres out of 39,527 acres were cropped twice a year and some land was only sown once in ten years.

The following are the average yields of wheat in maunds per acre obtained from crop-cutting experiments :—

	Fort Sandeman	Kila Saifulla	Hindubagh
Irrigated and manured ...	12	16	17·3
,, but unmanured ...	8	9·2	15·4
Unirrigated ...	6·5		

The varieties of wheat grown in the District are described in the *Gazetteer* as follows :—

"Two varieties of wheat are grown in the Hindubágh *tahsil*, viz., the *sárn ghanam* or winter wheat, which is white, and *tauda ghanam* or summer wheat, which is red and has a smaller grain. In Kila Saifulla two varieties are found *sra* or *red*, and *spín* or white wheat ; the red variety is largely

cultivated and is also common to Fort Sandeman, where three more varieties are recognised—*tor ghanam*, *orbasún ghanam* and *ghat ghanam*, all being indigenous to the country. The *tor ghanam* has a longish hard grain, yellowish in colour, the ear being dark, whence the name. The *orbasún ghanam* is reddish in colour, the grain is small and soft and the ear long but thin and yellow in colour. *Ghat ghanam* has a beardless ear which is thick but small, the grain being yellowish. All are cultivated equally in different parts of the *tahsíl* and the sowing operations extend from October to end of January."

The following samples of wheat were received from this District :—

Kila Saifulla tahsíl, Upper Zhob.

1. *Spín ghanam.* This variety is grown both on irrigated and unirrigated land. It is considered to require less water than *sra ghanam.*

Two samples of *spín* were sent from this *tahsíl*. The first labelled *Spín kosham* consisted of a wheat with very short, black awns, greyish white, densely felted, rounded glumes, and white grain (var. *meridionale* Keke. Class XXX). No impurities were present.

The other sample was very mixed but the two main constituents were : a bearded wheat with densely felted, light red chaff and awns and white grain (var. *turcicum* Keke. Class XV) and a fully bearded wheat with smooth, light red chaff and awns and red grain (var. *ferrugineum* Al. Class XXXII). There were also present as impurities a bearded wheat with felted, bright red chaff and pale red grain (var. *barbarossa* Al. Class XIII) and a bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Keke. Class XXXVIII).

2. *Sra ghanam.* This wheat is grown on both irrigated and unirrigated land. It is a bearded wheat with smooth, white chaff, very weak straw, and red grain (var. *erythrospermum* Keke. Class XLI). There was only one impurity, a similar wheat with white grain (var. *graecum* Keke. Class XLV).

3. *Mecca Muazzama.* This variety is said to have been imported from Mecca by *Hajis* and is considered to be most sacred. It cannot be sown without performing the ceremony of ablution necessary before offering prayers. It is cultivated to an insignificant extent to neutralize the effect of evil eye in a field. It is a macaroni wheat with an extraordinarily long grain even for a macaroni and with two peculiar ridges on the outer glume. The awns are black, the chaff white and felted and the grain white (var. *melanopus* Al. Class IV).

Hindubágh tahsíl, Upper Zhob.

4. *Spín ghanam.* This variety is also cultivated on irrigated land. The sample consisted mainly of a mixture of wheats all with white, densely felted and very rounded glumes, white grain and strong straw but with very varying amounts of bearding (var. *erythroleucon* Kcke. Classes XXVIII & XXIX). Some were almost fully bearded, others almost beardless. From the appearance of the sample it would seem as if a good deal of natural crossing had taken place. There was also present, as an impurity in small quantity, a bearded wheat with smooth white chaff and red grain (var. *erythrospermum* Kcke. Class XL).

5. *Sra ghanam.* This was a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLII). There were also present a bearded wheat with white, densely felted chaff, rounded glumes, poor straw and red grain (var. *Hostianum* Clem. Class XXIV); a similar wheat with white grain (var. *meridionale* Kcke. Class XXVI) and a bearded wheat with smooth, white chaff and white grain (var. *graecum* Kcke. Class XLV).

Kákar Khorásán sub-tahsíl, Lower Zhob.

6. *Sur ghanam* (red wheat). This is the variety most commonly grown in the locality. It is cultivated both on dry and irrigated land and is said to be rust-liable. One sample of this variety was sent. The ears were thin and badly matured. It was a fully bearded wheat, with smooth, red chaff and dark red grain (var. *ferrugineum* Al. Class XXXIII). There was a small quantity of a similar wheat with white grain present as an impurity (var. *erythroleucon* Kcke. Class XXXVII).

7. *Spín ghanam* (white wheat). Samples of this wheat grown in different villages were sent. Three of them consisted of a fully bearded wheat with smooth, white chaff, weak straw and white grain (var. *graecum* Kcke. Class XLV). A similar wheat with red grain was present as an impurity (var. *erythrospermum* Kcke. Class XL). This was the only impurity in the first sample, in the second there was also present a bearded wheat with strong straw, white, felted glumes and red grain (var. *fulgurosum* Al. Class XVIII), and in the third a fully bearded wheat with white felted glumes and white grain (var. *meridionale* Kcke. Class XXVI). The fourth sample was a red wheat with long, lax, fully bearded ears, smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XL).

Fort Sandeman tahsíl. Lower Zhob.

Four samples were sent from this *tahsíl*.

8. *Orbasín ghanam.* This wheat was somewhat difficult to classify. The grain was soft and large and resembled that of a rivet wheat but in other particulars the ears were those of a macaroni wheat. This wheat has short ears, long red awns and smooth, red chaff: the grain is white and soft and the straw strong with a pink tinge (var. *hordeiforme* Host. Class VIII). One ear was found which looked like a natural cross between this wheat and a common wheat. It was dense and flat and only half bearded.

9. *Tor ghanam.* This is also a macaroni wheat but with no peculiarities. It is a black awned wheat, the chaff white and felted with much blackening and the grain white, hard and long (var. *melanopus* Al. Class VI). There were present as impurities some *orbasín* wheat: a common wheat with black awns, white, felted chaff and red grain (var. *fuliginosum* Al. Class XX) and a common wheat fully bearded with smooth, white chaff and red grain (var. *ferrugineum* Al. Class XXXIII).

10. *Ghat ghanam.* This resembles the wheat *spín* from Pishín and other localities. It is almost beardless, with white, felted chaff, rounded glumes and white grain (var. *meridionale* Keke. Class XXX). There were present as impurities, in large quantity *sra ghanam*, and in small quantity a slightly bearded wheat with white, felted glumes and red grain (var. *Hostianum* Clem. Class XXIV), a practically beardless wheat with small tips, rounded glumes, smooth, white chaff and white grain (var. *albidum* Al. Class LXII), and a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLII).

11. *Sra ghanam.* This is a common wheat with medium, fully bearded ears, white awns and smooth, white chaff. The grain is small and red and the straw pink turning black on ripening and weak (var. *erythrospermum* Keke. Class XLII). There were also present as impurities some *Ghat ghanam;* a bearded wheat with black awns, white, felted chaff and red grain (var. *fuliginosum* Al. Class XX) and a macaroni wheat with red awns, smooth, red chaff and red grain (var. *murciense* Keke. Class VII).

CHAGAI.

The Chágai District (18,892 square miles in area) lies immediately south of the Baloch-Afghan boundary. The District is divided into three parts, the Nushki *tahsíl* on the east, the Chágai *sub-tahsíl* in the centre and the Western

Sanjráni Tract on the west. There is very little cultivation in the District, much of the country being sandy desert and much of it only suitable for grazing. The cultivation is mainly confined to the level plain of alluvial soil lying between Nushki and Chágai on which most of the rivers are situated.

There is only one river with a perennial flow of water, the Khaibar or Jo-i-Nushki which irrigates the land in the neighbourhood of Nushki (about 2,000 acres in 1905). There are in addition numerous hill torrents which supply flood water for the dry crop cultivation. These torrents are held up and directed into specially constructed channels by embankments which are generally made and repaired by a whole village or tribe who divide among themselves the water so obtained. There are a certain number of *kárézes* both in Nushki and Chágai but most of them are small and insignificant. The five largest in Nushki irrigate about 600 acres (1905) while in Chágai the largest *kárez* only irrigates 22 acres.

The average rainfall at Nushki is 4·5 inches derived from the winter storms which come from Persia but these vary from year to year. Usually no snow falls on the plains. The summer is very long, lasting from April to October and the temperature in the plains is high.

The soil in the cultivated tracts is alluvial and very fertile but, owing to the limited amount of water, nine-tenths of the cultivation is dry crop cultivation dependent on the flood water brought down by the hill torrents in winter and early spring. The best *khushkába* cultivation is found on the *Bál*, *i.e.*, the land lying along the course of the Lora. Other dry crop lands lie round Mal and Chágai. Most of the irrigated land lies round Nushki and Baghat and is watered from the Kaisar river.

The area under wheat is not known accurately but wheat represents about 95 per cent. of the total produce of the District. Wheat is always sown in fallow land and the land after a wheat crop is always left fallow for a year or two. In September the land is irrigated, ploughed and levelled, the seed being sown by drill at the beginning of October. The first irrigation is given when the wheat is 6 inches high and the crop is either grazed by sheep or cut for fodder in January. The second watering is given twenty days later, the third when the ears are formed and the fourth when the grain has set. The wheat is ripe in May or June. On unirrigated lands, the time of sowing depends on the winter rains and may take place at any time up to February. The seed is also sometimes sown in the dry land before the rains.

The average yield of wheat per acre in the Nushki *tahsíl* in 1905 was 6½ maunds, the highest yield being 8 maunds per acre on irrigated land. In Chágai, the cultivators say the outturn of wheat should be ten times the seed sown.

Six samples were received from the Chágai District.

Nushki tahsíl.

1. *Dahgak.* This is the wheat which the people prefer for food and which is most commonly grown. It is sown in both irrigated and unirrigated land. The bulk of the sample consisted of a common bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLI). There were also present as admixtures a wheat similar to the above but with white grain (var. *graecum* Class XLV); a bearded wheat with smooth, red chaff and red grain (var. *ferrugineum* Al. Class XXXII); a bearded wheat with smooth, red chaff and white grain (var. *erythroleucon* Kcke. Class XXXVIII) and a bearded wheat with white, felted chaff and red grain (var. *Hostianum* Clem. Class XXI).

2. *Turki.* This wheat is not very extensively grown and is only sown in irrigated land. The sample consisted of a mixture in equal parts of a partly bearded wheat with very rounded, white, densely felted glumes and white grain (var. *meridionale* Kcke. Class XXIX) and of a beardless wheat with smooth, white chaff and white grain (var. *albidum* Al. Class LIII).

3. *White wheat from Nushki village.* Three-quarters of the sample consisted of a wheat with very short awns, rounded, white, felted glumes and white grain (var. *meridionale* Kcke. Class XXIX). There were also present as admixtures in large quantity a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLI) and in small quantity a bearded wheat with felted, white chaff and red grain (var. *Hostianum* Clem. Class XXIV).

Chágai sub-tahsíl.

4. *Dahgak.* This was similar to the *Dahgak* wheat received from Nushki but there were no impurities.

5. *Turki.* This variety is only grown on irrigated land. The bulk of the sample consisted of a mixture of the partly bearded wheat with rounded, white, felted glumes and white grain (var. *meridionale* Kcke. Class XXIX) found in *Turki* from Nushki and of a somewhat similar wheat but fully bearded and with sharply keeled glumes (var. *meridionale* Kcke. Class XXVI). There

were also present as admixtures a bearded wheat with smooth, white chaff and red grain (var. *erythrospermum* Keke. Class XLI); a fully bearded wheat, with white felted chaff and red grain (var. *Hostianum* Clem. Class XXI); a similar wheat but very shortly awned and with short, rounded glumes (var. *meridionale* Keke. Class XXIV) and a bearded wheat with red, densely felted chaff and white grain (var. *turcicum* Keke. Class XV).

6. *Siah das.* This wheat, as the name implies, has much black colour on the awns and glumes. It is said to be grown mostly on irrigated land. The bulk of the sample consisted of a bearded wheat with smooth, red chaff with much blackening on the awns and glumes and red grain (var. *caesium* Al. Class XXXI). There were also present as impurities in very small quantity a similar wheat with white grain, a bearded wheat with white chaff and red grain (var. *erythrospermum* Keke. Class XLI) and a bearded wheat with red, felted glumes much blackened and red grain (var. *fuliginosum* Al. Class XIX).

KACHHI, KALAT.

Kachhi, the most easterly portion of the Khán of Kalát's dominions, adjoins the Nasírábád and Sibi *tahsíls* of the Sibi District and resembles these in many particulars. It consists of a flat, triangular plain surrounded by mountains. The altitude is nowhere above 500 feet, but there is an almost imperceptible slope from north to south.

The climate is like northern Sind excessively hot in summer and very dry. Unlike most parts of Baluchistán, there are only two seasons, summer and winter, and the former is much the longest. The rainfall is very small, about 3 inches.

The soil is very fertile if water is available but the irrigation water is not nearly sufficient for the whole area and there are large stretches of desert with no vegetation. There is a fringe of land under the hills which receives permanent irrigation but most of the cultivation is carried out on flood water from the rivers. There are numerous rivers and hill torrents in Kachhi of which the Nári, the Bolán, the Sukléji, the Múla, the Lahri and the Chattar are the most important. These streams are held up by enormous dams and the water is deflected into numerous side channels both natural and artificial. Some of the dams are very large but they are all of earth or sand and brushwood and break under sudden floods. They are made and repaired on a communal basis.

There is much waste of water due to want of system and organization and in especial the frequent breaking of these huge earthen dams leads to deflection and waste of water. In a very few places, notably on the Bolán, Persian wheels are used to lift the water. Apart from this flood irrigation, there seem practically no other sources of water. Only seventeen *kárézes* and nine springs are in use and there are hardly any wells.

Wheat is grown to the greatest extent on the west side of Kachhi as permanent irrigation exists there. It can only be grown on flood areas if floods have occurred in August and September.

Irrigated land is always fallowed for two years, if wheat is grown. It is seldom manured but sometimes bat's dung or pigeon's dung is spread over the field when the crop is a foot high. The land is watered and ploughed in October and the seed is sown broadcast. On irrigated land, the beam is never used. The second watering takes place when the wheat is three inches high and it is then watered about every fortnight, the length of the interval depending on the water-retaining power of the soil. Harvest takes place in April.

In dry crop cultivation, the land is ploughed and smoothed after the summer floods and sown with the drill in October.

On both irrigated and unirrigated lands barley is sometimes sown with the wheat.

Six samples were received from Kachhi, four from the Dhádar *tahsíl* and two from the Gandáva *tahsíl*.

Dhádar, Kachhi.

1. *Reli*. This wheat is said to have been introduced by the British. It is much liked and is now extensively grown. The beardless ears are very large and bold with fan-shaped apices. The chaff is white and felted but the felting seems to vary in density. The grain is white and hard and the very strong and stout straw is pink in colour turning black on ripening (var. *leucospermum* Keke. Class LIII). A similar wheat with smooth chaff was present (var. *albidum* Al. Class LXIII). The presence of these smooth ears combined with the variation in density of the felted ears makes it appear probable that in this sample we are dealing with the progeny of some natural cross between a smooth and a felted wheat.

2. *Baj*. This is said to be a red wheat and to be valued less highly than *Reli*. Seven-eighths of the sample however consisted of a wheat

with white grain. The ears were beardless with small tips and the glumes red and felted (var. *Delfii* Keke. Class XLVIII). One-eighth consisted of a similar wheat with red grain (var. *pyrothrix* Al. Class XLVI). There was also present in small quantity a beardless wheat with smooth, light red chaff and white grain (var. *alborubrum* Keke. Class LVIII).

3. *Wáru white wheat.* As this variety is considered of poor quality, it is termed *wáru* which means inferior. It is generally grown on land which is not under permanent irrigation. Two-thirds of the sample was composed of a bearded wheat with slender heads, smooth, white glumes, red grain and weak straw (var. *erythrospermum* Keke. Class XLII) and one-third consisted of a similar wheat with felted chaff (var. *fuliginosum* Al. Class XIX). There was also present in very small quantity a bearded wheat with smooth, white glumes and white grain (var. *graecum* Keke. Class XLV).

4. *Wáru red wheat.* This is also grown in unirrigated land and is of poor quality. This variety was a somewhat curious one. The ear shape is that of a common wheat but the glumes are sharply keeled to the base like those of a macaroni. The straw is almost solid but is stout not thin as in a macaroni wheat. The grain is large and like that of a rivet in shape. The ears are bearded, the glumes smooth red and the grain white (var. *erythroleucon* Keke Class XXXVIII). Only one impurity was present, a somewhat similar wheat with red grain (var. *ferrugineum* Al. Class XXXII).

Gandáva tahsíl.

5. *Thori.* This was a very mixed sample, containing nine different wheats. Although *thori*, meaning bald, generally denotes a beardless wheat the main constituent was a bearded wheat with slender ears, smooth, white glumes, red grain and weak, pink straw which turns black on ripening (var. *erythrospermum* Keke. Class XLII). There were also present in fair quantity a beardless wheat with short tips, white, densely felted glumes and white grain (var. *leucospermum* Al. Class LV); a similar wheat but with quite beardless ears and red grain (var. *velutinum* Schübl. Class LI), a beardless wheat with smooth, white chaff, red grain and pink straw which turns black on ripening (var. *lutescens* Al. Class LXI). There were present in very small quantity a beardless wheat with white chaff and white grain (var. *albidum* Al. Class LXII); a beardless wheat with smooth, red chaff and red grain (var. *milturum* Al. Class LVI); a beardless wheat with red, felted chaff and red grain (var. *pyrothrix* Al. Class XLVI); a bearded wheat

with black awns, greyish white, densely felted glumes and red grain (var. *fuliginosum* Al. Class XX), and a dwarf wheat with smooth, white chaff, white grain and pink straw (var. *Humboldti* Kcke. Class X).

6. *Wáru wheat.* This sample was also very mixed, eight different wheats being found in it. The main constituent was a beardless wheat with small tips, light red, felted glumes, white grain and good straw (var. *Delfii* Kcke. Class XLVIII). There were also present as impurities a similar wheat with red grain (var. *pyrothrix* Al. Class XLVI); a beardless wheat with short tips, smooth, light red chaff and red grain (var. *milturum* Al. Class LVI); a similar wheat with smooth, white chaff and red grain (var. *erythrospermum* Kcke. Class XLII); a beardless wheat with smooth, red chaff and white grain (var. *alborubrum* Kcke. Class LVIII); a beardless wheat with dense ears with fan-shaped apices, white, felted glumes, white grain and very strong straw (var. *leucospermum* Kcke. Class LIII), and the same dwarf wheat as in the sample of *Thori* (var. *Humboldti* Kcke. Class X).

MAKRAN, KALAT.

This is one of the maritime divisions of the Kalát State. The coast is practically a desert owing to the nature of the soil, which is impregnated with salt, and the scanty rainfall. From the level clay plains of the coast rise table hills and behind these lie ranges of high mountains, parallel with the coast and intersected by narrow valleys, in which the cultivation is carried on.

The climate varies greatly. The central inland portion is extremely hot and dry while the higher valleys such as Panjgúr are fairly temperate. There are three seasons, spring from March to May, summer from June to October and winter from November to February. The seasons in Panjgúr are about a month later than in Kéch. The rainfall is very uncertain but never exceeds a few inches. None may be received for two or three years. The rain generally comes in the form of storms between November and March and in July and August. On the west, the winter rainfall is the greatest, on the east the summer rainfall. As most of the rain falls in the hills sudden floods, which do great harm to cultivation, are common on the plains.

There are several rivers in Makrán of which the Dhast, the Rakhshán, the Tank and their affluents are the most important. From most of these rivers irrigation is carried out by means of *kaur-jos* or open channels leading from pools. In almost all the rivers, the river bed expands at short intervals

into shallow pools, the intervening stream flowing over a pebbly bed. These pools are often increased or deepened by artificial means and an open channel is constructed to carry the water on to the land. The construction and cleaning of these channels is done by co-operation between the members of a village or a family just as in the case of a *kārēz*. A considerable area is irrigated in this manner. There is a tradition that large dams used to exist at certain places but at present the number of dams is insignificant.

A large area is under *kārēz* irrigation, and the remains of old *kārēzes* show that this area used to be considerably larger.

A certain number of wells are also used for cultivation. Two systems of water lift are in use, the ordinary Indian bucket lift or *dhēnkalī* and the *galjalī* system from Sind. The leather bucket in this case has an elongated tube at the bottom and can be opened automatically by a rope attached to the yoke.

Very little wheat is grown, the local requirements being met by importation from Karāchi and other places. It is generally grown on irrigated land except in Panjgūr where the irrigated land is so closely planted with dates that the wheat will not grow. The crop is however grown on unirrigated land in Panjgūr. Practically all the wheat grown on irrigated land is grown under dates (they are not so closely planted as in Panjgūr) and the yield is therefore poor.

For irrigated cultivation, the land is ploughed as soon as the last wheat crop is removed. It is then ploughed again after the date harvest, and after the 20th of October the land is watered and sown broadcast. The field is then ploughed and levelled with the beam. This is the best time to sow but sowings can be extended to December. The first watering is given when the plant has tillered (termed *chak o māt* or mother and sons) about a month after sowing. The second watering is given about a fortnight later and the third two months after sowing. The wheat is then grazed. Harvest takes place in March or April.

On unirrigated land the wheat is sown with the drill. The best dry crop lands are the embanked fields of the Rakshān river. The land is generally ploughed and levelled after the summer rainfall and sown in October but in some cases the water-holding capacity of the soil is so great that even when irrigated in February, if ploughed and levelled at the time, it can be sown in October or November. To ensure a good crop, rain is necessary during the first sixty days.

Wheat in Makrán especially in Kolwa is liable to damage by the rice-stem fly. The local name of this is *dard* or pain because the stalks collapse as if in pain. The remedy adopted by the people is the application to the field of the dried blood of goats or sheep which have been killed on the *Id-uz-zuha*.

The following is the description of the varieties of wheat given in the Makrán *Gazetteer* :—

"The generic term for wheat is *galla* ; and its varieties are known as *mátoshag* and *chirok*, which are most extensively cultivated in the Kéch valley and *panáro* or *pazhmak*, which are commonest in Buléda, Zámurán and Panjgúr ; another kind is *dahak* which is grown in Panjgúr. The colour of both *mátoshag* and *chirok* wheat is red but the latter is somewhat darker than the former. *Mátoshag* is famous for the size of its grain. It is cultivated only on a limited scale, as it is easily affected by *dard*. *Chirok* is considered the variety indigenous to Makrán and the grain is very small except in Panjgúr. It is much appreciated for its flavour and sweetness, and is popular for parching when green (*tápag* and *mushag*). It is very sweet to the taste and in Panjgúr and other localities is sown in equal proportions with other varieties. *Panáro* is the largest wheat grown in the country and is lighter in colour and rounder in shape than the others. Bread made from it, however, is not so sweet as that made from *chirok* nor so nutritious as that made from *dahak*. *Dahak* resembles *chirok* but is larger and yellower in colour. Locally it is considered the equal of Mastung wheat in taste and quality but is believed to be even more nutritious."

Seven samples were received from Makrán.

Panjgúr.

1. *Dahak*. This is the common wheat of Panjgúr. The ears are lax, fully bearded with smooth, white glumes, dark red grain and weak, pink straw (var. *erythrospermum* Keke. Class XLII). There were also present in small quantity a bearded wheat with smooth, red glumes and red grain (var. *ferrugineum* Al. Class XXXIV), and a bearded wheat with white, slightly rounded, sparsely felted glumes with red grain (var. *Hostianum* Clem. Class XXI).

2. *Shutur dandan*. This variety is said to be not quite so commonly grown as *Dahak* but the sample received was very similar to *Dahak*. The only differences which could be noticed were a weaker straw and a shorter ear in *Shutur dandan*. There was only one impurity, a bearded wheat with smooth

white chaff and white grain (var. *graecum* Keke. Class XLV). It seems probable that the real *Shatar Dandan* was not sent.

3. *Pandaro*. This is the least cultivated of the three kinds. The sample was a mixture of a macaroni wheat with white awns, smooth, white chaff and white grain (var. *leucomelan* Al. Class IX) and a rivet wheat with short ears, black awns, white, densely felted glumes and white grain (var. *Salomonis* Keke. Class I). There were also present in small quantity two other macaroni wheats, one with red awns, smooth, red glumes and red grain (var. *marcicum* Keke. Class VII), and one with white awns, white, lightly felted glumes and white grain (var. *melánopus* Al. Class VI).

Kéch.

4. *Chirok*. Sample A grown on irrigated land. This is the common wheat of Kéch. The ears are bearded and very small with black awns and smooth, red, rounded glumes. There is some blackening on the chaff and the red grain is small and rounded (var. *caesium* Al. Class XXXI). This variety resembles very closely some of the wheats of Bihar.[1] These also have small, rounded grain, small heads and much blackening on the chaff. As far as is known, such wheats are found nowhere else in India and it is curious that *Chirok* which is supposed to be the wheat indigenous to Makrán should be almost identical with the wheats of so distant a part of India as Bihar.

Sample B, grown on dry land, resembled the first sample but the heads were bigger and the straw stronger.

5. *Mátoshag*. This wheat is less commonly grown than the *Chirok*. The ears are short, very dense and square. The awns are black and long and the glumes red and densely felted. The grain was red (var. *barbarossa* Al. Class XI).

6. *Kato*. This variety is considered to be a delicacy and is only eaten parched. It is only grown in very small quantities. The ears are beardless with smooth, red glumes. The grain is white and rounded and the straw stout and black when ripe (var. *albanidrum* Keke. Class LVIII).

A set of samples was received from one of the Districts without any indication of the place of origin. These samples were labelled *Saloman raz*, *Bati raz*, *Kumar*, *Shahdera* and *Khudadadaraz*.

1. *Saloman raz*. The main constituent of this sample (forming five-sixths of the total) somewhat resembled the *Spin* wheat received from

[1] Howard and Howard, *Wheat in India*, p. 201.

Pishin. The lax ears had short awns, the glumes were rounded, white and felted, the grain white and the straw strong (var. *meridionale* Ecke. Class XXIX).

2. *Khudadadarzi.* Seven-eighths of the sample was the same as sample 1.

3. *Bati razi.* Two-thirds of the sample was identical with the other two.

4. *Kumar.* This was a mixture of the wheat described above and a bearded wheat with smooth, red chaff and red grain (var. *erythrospermum* Ecke. Class XLIII). This wheat was also present in small quantity in samples 1, 2, 3.

5. *Shahderzi.* This was a similar mixture to *Kumar.*

The following wheat was present in all the samples in small quantity : a bearded wheat with white, felted glumes and white grain (var. *meridionale* Ecke. Class XXVI). A similar wheat with red grain (var. *Hostianum* Clem. Class XXIV) was also present in samples 1, 2, 4, and 6. A bearded wheat with smooth, white glumes and white grain (var. *graecum* Ecke. Class XLV) was present in samples 1, 3, 4, 5. Sample 2 which was very mixed contained in addition to the above mentioned impurities a bearded wheat with red, felted glumes and red grain (var. *barbarossa* Al. Class XIII), and a bearded wheat with smooth, red glumes and white grain (var. *erythroleucon* Ecke. Class XXXVIII), while a similar wheat with red grain (var. *ferrugineum* Al. Class XXXIII) was present in sample 1. Samples 3 and 5 also contain a wheat with short awns, white, felted glumes and red grain (var. *Hostianum* Clem. Class XXII).

In the description of the various agricultural processes in vogue in Baluchistán, full use has been made of the information in the Gazetteers of the various Districts.

THE WHEATS AND BARLEYS OF KHORÁSAN.

I. INTRODUCTION.

In 1910, a report on the agriculture of Khorásán was published by Major Sykes, (now Sir Percy Sykes) Consul-General and Agent of the Government of India in Khorásán. Samples of the wheats were also sent to Pusa for classification.

Khorásán, with an average altitude of 3,000 to 4,000 ft., lies in the north of the Irán plateau which includes the whole of the uplands of Persia and Afghánistán. The climatic conditions resemble those of the higher parts of Baluchistán. The temperature rarely falls below zero in winter and the highest temperature in summer is about 100° with cool nights. Snow falls in December, January and February but the average combined snow and rainfall is only 10·20 inches per annum. In common with Seistán and Baluchistán, Khorásán suffers very much from strong, dry winds, notably the "wind of 120 days." The soil most commonly found is known as *kirmiz* or crimson and is a dark coloured loam.

The following account of the cultivation of wheat is taken from Major Sykes' report:

"Land destined for wheat or barley has very frequently been fallow for as much as five or six years, during which period it has either remained almost bare with a few thorns growing on it, or if naturally comparatively moist, it is covered with liquorice which has a deep root, but which is of no value as a crop, although it is used for binding round a broken limb and as a specific against fever. The first ploughing generally takes place when the land is wet during the spring, and this ploughing is repeated two or three times. In the autumn, the land is levelled and divided into suitably sized plots called *kala* by means of tiny ridges known as *pal*. A *kala* for wheat or barley is from 3 to 5 *zars*[1] wide and from 10 to 50 and sometimes 100 *zars* long. It all, however, depends on the nature of the ground and the volume of the water. After again being watered, the seed is thrown on broadcast. In this connexion, land is generally flooded to a depth of three inches for grain crops; but to

[1] 1 *zar* = 40·95 inches.

about half this depth for melons and cucumbers. Finally, the seed is covered by means of a log harrow, *mala*, which is drawn over it with a man sitting on it. Sowing, I would mention, goes on all through the winter except when the ground is ice-bound or covered with snow, the custom being to sow 2 *kharwars*[1] at the main autumn sowings and 1 *kharwar* in the spring and at odd times.

In the large majority of cases, there is no manure used and the land is not given the preliminary ploughing. Land used for rain crops is never manured, but the seed is scattered broadcast after rain, the land is ploughed, levelled by the board harrow and left to chance. Occasionally rain crop land is given a preliminary ploughing.

Weeding is not done in the case of irrigated wheat and barley crops, but once with rain crops. Vegetables and opium are carefully weeded. Wheat and barley are well up before the winter sets in and do not appear to suffer from the frost although occasional snowfalls are considered to be desirable. In the early spring, when the crops are about eight inches up, they are either cut down or grazed. Apart from the value of the fodder, this is thought to strengthen the crop.

A large crop depends mainly on the rainfall in March, April and May, and the cultivator only waters his wheat and barley three times after 21st March, if the rainfall be good. When the ear begins to form, no more water is given and late rains, *i.e.*, after the end of May cause rust. It, however, partly depends on the nature of the soil. In some cases, water is given in the interval commencing from the formation of the ear and the ripening of it. No water, however, is given after the kernel has been formed. A cultivator can see by the colour of the leaf if water is required. If the leaf assumes a dark hue he knows that the field is thirsty and requires water, but if he sees the leaf inclined to be yellow, he stops the water till the leaf has assumed its natural colour. By the middle of June around Meshed, the barley crop is ripe and the wheat follows about a fortnight later. Neither rain nor frost is to be feared at this season, so operations are conducted in a leisurely fashion.

The actual reaping is done with a somewhat blunt sickle and the bundles are not tied up but thrown together. Later, they are collected into a round rick near the threshing-floor.

The threshing is carried out by means of unmuzzled oxen which are yoked to a wooden instrument termed a *gardu* (roller), on which a man sits. As the

[1] 1 *Kharwar* = 650 lb.

oxen move round, two wooden wheels furnished with spikes cut up the straw which is much shorter and finer than in England.

Winnowing is carried out by throwing everything into the air by means of a wooden fork termed *charlakh* (four pointed) when the dust and chaff flies away. There is, generally speaking, a steady breeze in the afternoons.

The grain is left in heaps, generally with some private marks on them until the share of the landlord or the revenue be paid. It is then carried into the granary and thrown in a heap on to a mud floor.

In the hills land which is generally terraced is sometimes cropped every year. Owing to the silt being abundant, this is possible, but land is allowed to be fallow when sufficiently abundant.

Both wheat and barley are grown either as a rain-fed crop, *daima*, or by irrigation, *abi*.

The proportion of these two crops varies enormously according to the amount and seasonableness of the rainfall. In a good year, in the valleys, 30 per cent. of the wheat may be rain fed: in the hills the percentage rises to 65 per cent. Rain-fed wheat always fetches *toman*[1] 1 to *tomans* 2 per 650 lb. more than irrigated wheat. The reason for this is that one *man* (6½ lb.) of rain-fed flour makes 1¾ *man* of bread, whereas, at most, 1½ *man* is made from the irrigated article. Moreover, the bread made from rain-fed wheat keeps good for three days and is sweeter than the other: but bread baked from the irrigated article can only be eaten fresh.

Abi wheat seed is never used to grow *daima* as it does not turn out well: *daima* seed can be sown for *abi* with very good results. One *man* of *daima* seed is sown in as much ground as would take three *mans* of *abi* seed. The proportion in the produce is the same. *Daima* produces on an average 30 grains for one grain and *abi* only ten to twenty grains. It is calculated that 360 grains are sown per square metre or *zar*. As Persians say, 'every footprint of a goat should have a grain sown.' Another calculation is that 10 *man* or 65 lb. per acre are sown per *jarib* or acre of stony ground and 13 *man* or 84½ lb. per acre in good soil without stones. There is no difference in the value of the two species of barley. Barley, however, which is sown for a late crop is termed *tursh* or bitter and is not considered fit for anything except for donkeys.

Wheat is of the following varieties: — 1. *Daima* (*a*) *Kalkari*, (*b*) *Kalh Ali Khani*, (*c*) *Safed Khasha*, (*d*) *Surkh Das*. (*a*) the ear and the grain is red:

[1] 1 *toman* = 4 shillings.

there is no beard and the grain is big ; (*b*) ear and beard red, grain also red but inclined to be yellowish, size of grain medium ; (*c*) ear and beard white like paper, the grain is also white ; (*d*) ear and beard and grain red, the grain is small and fine like rice.

2. *Abi*–(*a*) *Kar-i-Safid*, (*b*) *Kar-i-Kirmiz*, (*c*) *Siah Das*, (*d*) *Shutur Dandan* ; (*a*) ear is full and white, with short beard, the grain is white and big ; (*b*) ear is red with short beard, the grain is yellow ; (*c*) ear and beard black, the grain is yellow and very transparent ; (*d*) the ear is between red and yellow in colour, the beard is small and the grain red.

From the milling point of view, the best wheat is *Surkh Das*, both of the *daima* and *abi* classes.

On the uplands of Persia, wheat takes from seven to nine months to mature, but in the hot country only four to four and a half months. These periods approximately correspond with the eight months of England and the four and a half months of India."

II. CLASSIFICATION AND DESCRIPTION OF THE WHEATS.

A. CLASSIFICATION OF THE WHEATS OF KHORÁSÁN.

Triticum durum Desf. Macaroni wheats.

1. Glumes felted.

A. Glumes white, awns white, grain white.

var. *Valenciæ* Keke.

Khorásán Class I.

B. Glumes white, awns black, grain white.

var. *melanopus* Al.

Khorásán Class II.

TRITICUM VULGARE VILL. COMMON WHEATS.

I. Ears bearded.

1. Glumes felted.

A. Glumes red.

a. Grain white.

var. *turcicum* Keke.

Khorásán Class III.

B. Glumes white.

a. Grain red.

var. *Hostianum* Clem.

Khorásán Class IV.

b. Grain white.

var. *meridionale* Keke.

Khorásán Class V.

2. Glumes smooth.

A. Glumes red.

a. Grain red, awns red.

var. *ferrugineum* Al.

Khorásán Class VI.

b. Grain white.

var. *erythroleucon* Keke.

Khorásán Class VII. Ears fully bearded, glumes not rounded.

Khorásán Class VIII. Ears only partly bearded, glumes very rounded.

B. Glumes white.

a. Grain red.

var. *erythrospermum* Keke.

Khorásán Class IX.

b. Grain white.

var. *graecum* Keke.

Khorásán Class X.

B. DESCRIPTION OF THE WHEATS OF KHORÁSÁN.

TRITICUM DURUM DESF. MACARONI WHEATS.

Ears flat; flowering glumes with long awns, outer glumes sharply keeled to the base; straw stiff and solid; grain long.

var. *Valenciæ* Kcke.

Khorásán Class I. Ears very long and thin, awns white; chaff felted, white; grain white, long, very thin and translucent.

To this class belongs *Shutur Dandan.* The sample was not well matured and had apparently suffered from shortness of water. A few ears were also found as an impurity in the sample of *Safed Khosha.* This variety is also reported from Valencia in the Russian Province of Charkow and Chile.[1]

var. *melanopus* Al.

Khorásán Class II. Awns black; chaff felted, white with some blackening; grain white, long, thin, translucent, larger than the grain of *Shutur Dandan.*

To this class belongs *Siah Das.* A few similar ears were also found as an impurity in the sample of *Shutur Dandan.*

Triticum vulgare Vill. Common wheats.

Ears bearded or beardless: outer glumes not keeled to the base; straw hollow; grain neither very long nor very round.

var. *turcicum* Kcke.

Khorásán Class III. Ears short, fully bearded; awns red; chaff felted, red; grain white; straw thin.

Only one ear of this wheat was found as an impurity in the *Kar-i-Safid.*

var. *Hostianum* Clem.

Khorásán Class IV. Ears medium to lax, fully bearded; chaff felted, white; grain red, somewhat large, plump.

A very small amount of this wheat was found in the samples of *Kar-i-Safid.* The consistency of the grain was soft.

var. *meridionale* Kcke.

Khorásán Class V. Ears somewhat square, medium to lax, fully bearded, awns stiff; chaff felted, white; grain white, somewhat large, plump with a distinct hump; straw fairly stiff.

About one-tenth of the sample *Kar-i-Safid* belongs to this class. The grain had the peculiar dead white colour characteristic of grain in this part of the world and the consistency was medium to hard.

[1] Koernicke, l.c.

var. *ferrugineum* Al.

Khorásán Class VI. Ears long, thin, lax, fully bearded, awns light red; chaff smooth, very light red, shining; grain red.

This variety occurs in very small quantities in *Surkh Das* and in *Kar-i-Safid*.

var. *erythroleucon* Kcke.

Khorásán Class VII. Ears long, thin, lax, fully bearded, awns light red; chaff smooth, very light red, shining, grain large, white.

The wheat *Surkh Das* belongs to this class. This variety also formed about one-tenth of the sample *Kalkori* and occurred as a small impurity in *Kar-i-Safid*.

Khorásán Class VIII. Ears lax, not very long, with short beards along the whole length, awns light red; glumes rounded, smooth, light red with some bloom; grain somewhat large with a distinct hump, white, almost translucent.

The sample *Kalkori* belongs to this class and a similar wheat was also found in small quantity in *Surkh Das*. This wheat resembles in glume-shape and bearding the wheats found on the Simla Hills and while belonging to *T. vulgare* Vill. forms a link between this and *Triticum compactum* Host.

var. *erythrospermum* Kcke

Khorásán Class IX. Ears fairly long, lax, fully bearded, awns white; chaff smooth, shining white; grain light red, fairly large with a distinct hump.

The bulk of the sample *Kar-i-Safid* belongs to this class. This variety also formed about one-tenth of the sample *Safed Khosha*.

var. *graecum* Kcke.

Khorásán Class X. Ears long, thin, lax, fully bearded, awns white; chaff smooth, white; grain somewhat large and white.

To this class belongs the *Safed Khosha* but the sample appears to contain two sub-varieties, one with rounded glumes and plump, soft, white grain and the other with longer, flattened glumes and translucent, horn, amber grain.

About one-eighth of the sample of *Kar-i-Safid* also consisted of a wheat belonging to this class, probably to the sub-variety with plump grain, and a very small quantity was also found in *Shutur Dandan*.

The constitution of the six samples received may therefore be summed up as follows :—

1. *Daima*—Rain-fed wheats.

(*a*) *Kalkori* consists mainly of a wheat with very short awns (var. *erythroleucon* Kcke.) with almost translucent white grain. It is mixed to the extent of about one-twentieth with a wheat belonging to the same variety which is also white-grained but differs from the real *Kalkori* in the amount of bearding and shape of the glumes.

(*c*) *Safed Khosha* consists mainly of wheats belonging to var. *graecum* Kcke. with white grain. It is probable that two sub-varieties, one with plump, soft, white grain and the other with amber, translucent grain occur. There is also admixture to about one-twentieth of var. *erythrospermum* Kcke. with red grain and a very small amount of *Shutur Dandan* wheat.

(*d*) *Surkh Das* consists mainly of var. *erythroleucon* Kcke. with large, soft, white grain. It contained a fair amount of *Kalkori* and a very small amount of two wheats with felted chaff, one with white and one with red grain.

2. *Abi.*—Irrigated wheats.

(*a*) *Kar-i-Safid.* This, according to Major Sykes' report, should be a wheat with a white grain. The sample received under this name consisted, however, in the main (three-quarters of the whole) of a red-grained wheat belonging to var. *erythrospermum* Kcke. A white-grained, smooth-chaffed wheat (var. *graecum* Kcke.) formed about one-eighth and a white-grained, felted wheat (var. *meridionale* Kcke.) about one-tenth of the sample. It also contained small amounts of var. *Hostianum* Clem., var. *erythroleucon* Kcke., var. *ferrugineum* Al. and of var. *turcicum* Kcke. This was the most mixed sample received.

(*b*) *Siah Das* consisted entirely of the macaroni wheat, var. *melanopus* Al. The sample was quite pure and the black colour of the awns well developed, although the grain was slightly shrivelled. This wheat is probably identical with one of the wheats of Baluchistán.

(*d*) *Shutur Dandan.* This is also a macaroni wheat belonging to the variety *Valenciæ* Kcke. This variety occurs nowhere in India but is reported from Valencia in the Russian Province of Charkow and Chile. The sample received was badly matured, having obviously suffered from drought. It contained as impurities very small amounts of *Siah Das* and of a wheat belonging to var. *graecum* Kcke.

The fact that two of the *abi* wheats are macaroni wheats which require a large amount of water explains the statement made by Major Sykes that *abi* seed is never used for *daima* sowings.

The chief characteristics of the Khorásán wheats are the drawn out appearance of the ears owing to their thinness and laxity, the absence of colour, and the large size of the grain. The long, lax ears with their awns and glumes adpressed to the rachis form a strong contrast to the thicker, squarer ears with bristling awns found in India, although these again appear thin in contrast with European samples. The grain on the whole is large, probably due to the laxity of the ear. The peculiar dead white colour found in Baluchistán is also found here and even when the chaff is red, it is a very pale red. The only strong colour shown was the black of the awns in *Siah das*, which was very well developed. The dryness of the atmosphere was well shown in the clear, shining chaff and straw.

III. THE BARLEYS OF KHORASAN.

Four samples (grain) of barley were also received but no ears.

The following description of the varieties is therefore taken from Major Sykes' report :—

" Barley falls under the following headings :—

1. *Daima*—
   - (*a*) *Siah.*
   - (*b*) *Kuchani* all called *dopar* or two rows of grain.
   - (*c*) *Mushi.*
   - (*a*) Ear black ; beard long ; and grain black.
   - (*b*) Ear yellow ; beard and grain yellow.
   - (*c*) Ear, beard and grain white.

All the above are sown during the month preceding *Nauroz* (21st March).

2. *Abi*—
   - (*a*) *Jo shal.*
   - (*b*) *Jo zard.*
   - (*c*) *Jo siah.*
   - (*a*) Ear is white, thin and long ; grain is white and thin with long beard. Four rows of grain.
   - (*b*) Full ear, yellow bearded, six rows ; grain is big ; ear, beard and grain yellow.
   - (*c*) Ear, beard and grain black, with six rows of grain. The ear is full.

The *Jo kuchani* is considered to be the best."

The following were the samples received :—

Abi.—Jo shal.

Daima.

(*a*) Siah.

(*b*) Kuchani.

(*c*) Mushi.

The sample of *Jo shal* was exceedingly poor and thin and had evidently been grown under very unfavourable conditions. The three *daima* samples were better grown but even they had suffered from want of water, the grains not being properly filled. The fracture of all three was fair, that of *Jo kuchani* being the best, while as regards colour *mushi* was better than *kuchani*. All were mixed with wheat and weed seeds and the sample of *siah* consisted partly of black barley and partly of white. It is possible that with good cultivation both *kuchani* and *mushi* might give fair malting samples.

THE WHEATS OF THE KURRAM VALLEY, NORTH-WEST FRONTIER PROVINCE.

I. INTRODUCTION.

THROUGH the kindness of Mr. S. E. Pears, I.C.S., Political Agent in Kurram, samples of the various kinds of wheat grown in the Kurram Valley were obtained. Seven samples were sent which were all considered to be distinct varieties by the local farmers.

The following samples were received:—

No.	TRACT	VILLAGE	VARIETY
1.	Rodghara	Shakh	Red
2.	Rodghara	Shakh	White
3.	Daman	Shiblan	Red
4.	Daman	Shalozan	Red
5.	Daman	Zeran	White
6.	Daman	Zeran	Red
7.	Sahra	Párachinár	White

The Kurram Agency forms part of the North-West Frontier Province and consists of a long, narrow valley (length 72 miles, breadth 12 to 24 miles). It is bounded on the north-east by the Safed Koh Range of the Himalayas whose highest peak Sikharám, 15,620 ft., is at the extreme north-west corner of the Agency. Other lower ranges form the boundary on the west and on the south and from the southern range runs a spur which divides the valley into two parts, Upper and Lower Kurram. Thus Upper Kurram is almost surrounded by mountains. The Kurram River, a tributary of the Indus is the only river in the Valley. Párachinár (the head-quarters) and most of the villages are situated on the wide open plain of Upper Kurram whereas only narrow strips of cultivation along the river banks are found in Lower Kurram. In Lower Kurram the summer is hot and dry and the winter cold with a bitter wind, while in Upper Kurram the summer is never very hot but snow lies on the ground for weeks in winter. The highest temperature at Párachinár was 97°—100° and the minimum 11°·8 in 1900.

Generally speaking, the North-West Frontier Province has two wet seasons, one due to the monsoon and one to winter storms from Mesopotamia

and Persia bringing rain and snow. Both are precarious and may fail entirely.

The soil of the Kurram Valley is very fertile wherever irrigation is obtainable. Owing to the unsettled nature of the country in the past, however, no permanent system of irrigation has been made and irrigation is only carried on by small channels made and owned by a hamlet or a family. There are two harvests, the autumn harvest of rice, maize and oilseeds and the spring harvest of wheat, barley and clover, of which the former is the more valuable although the spring harvest is now increasing in importance.

II. CLASSIFICATION AND DESCRIPTION OF THE WHEATS.

A. CLASSIFICATION OF THE WHEATS OF THE KURRAM VALLEY.

TRITICUM VULGARE VILL. COMMON WHEATS.

I. Ears bearded.

1. Glumes smooth.

A. Glumes red.

(*a*) Grain red.

var. *ferrugineum* Al.

Kurram Valley Class I.

(*b*) Grain white.

var. *erythroleucon* Kcke.

Kurram Valley Class II. Ears long; grain long, somewhat grey in tone; straw stout.

Kurram Valley Class III. Ears short; glumes short and rounded; grain short with a distinct hump, yellow in tone; straw weak.

B. Glumes white.

(*a*) Grain red.

var. *erythrospermum* Kcke.

Kurram Valley Class IV. Ears long; glumes long; grain long, very pale yellowish red.

Kurram Valley Class V. Ears short; glumes short and rounded; grain short with a distinct hump, bright red in colour.

(*b*) Grain white.

var. *graecum* Ecke.

Kurram Valley Class VI.

B. DESCRIPTION OF THE WHEATS OF THE KURRAM VALLEY.

Triticum Vulgare Vill. Common wheats.

Ears bearded or beardless: outer glumes not keeled to the base: straw hollow; grain neither long nor round.

var. *ferrugineum* Al.

Kurram Valley Class I. Ears medium, fully bearded; chaff smooth, brownish red; grain pale red; straw pink, turning grey on ripening.

It is possible that the wheats belonging to this class could be divided into two sub-classes with grain of different tones of red but the specimens are not well enough grown to state this with certainty.

Wheat belonging to this class occurred in all the samples as an impurity; in fair quantity in sample 6 from Zeran, Daman and in sample 1 from Shakh, Rodghara; in small quantity in sample 3 from Shiblan, Daman, sample 5 from Zeran, Daman, sample 4 from Shalozan, Daman, sample 2 from Shakh, Rodghara, and sample 7 from Párachinár, Sahra.

var. *erythroleucon* Al.

There appear to be two classes within this botanical variety, differing in the shape of the glume and of the grain.

Kurram Valley Class II. Ears long, medium, square, fully bearded, awns red; glume-shape normal; chaff smooth, brownish red with a bluish bloom; grain long, white, somewhat grey in tone; straw strong, almost solid, pink turning black on ripening.

To this class belong sample 3 from Shiblan, Daman, sample 5 from Zeran, Daman, and sample 1 from Shakh, Rodghara.

Kurram Valley Class III. Ears short, medium, square, fully bearded, awns red; glumes somewhat rounded, smooth, brownish red with a bluish bloom; grain short with a distinct hump, yellow in tone; straw thin, pink, turning grey on ripening.

To this class belongs sample 4 from Shalozan, Daman, and a small part (about one-third) of sample 7 from Párachinár, Sahra.

Single ears belonging to these classes are difficult to distinguish from one another but in the mass the wheats present a very different appearance. The wheats belonging to Class II are strong and vigorous with a large beard and stout straw, while those in Class III are much smaller and weaker.

var. *erythrospermum* Kcke.

There are again two classes belonging to this botanical variety differing in the shape of the glume and the shape of the grain.

Kurram Valley Class IV. Ears long, medium to lax, fully bearded, awns white ; glumes long, smooth, yellowish white with a reddish tinge ; grain long, thin, very pale red, yellow in tone.

To this class belongs sample 2 from Shakh, Rodghara.

Kurram Valley Class V. Ears medium in length, medium to lax, fully bearded, awns white ; glumes short and rounded, smooth, white with a reddish tone ; grain short, with a distinct hump, red, a deeper red than in Class IV and without the yellow tint of the latter.

Wheats belonging to this class were only found as admixtures : in fair quantity in sample 7 from Párachinár, Sahra, and in small quantity in sample 3 from Shiblan, Daman, sample 4 from Shalozan, Daman, and sample 5 from Zeran, Daman.

The difference in the shape and grain colour between these two classes is very great.

var. *graecum* Kcke.

Kurram Valley Class VI. Ears long, medium, fully bearded ; awns white ; chaff smooth, white with a reddish tone ; grain long, white ; straw fairly strong, pink, turning grey on ripening.

Wheats belonging to this class were only found as an impurity in some of the samples. They were found in fair quantity in sample 3 from Shiblan, Daman, and in sample 2 from Shakh, Rodghara ; in very small quantity in sample 4 from Shalozan, Daman, and sample 7 from Párachinár, Sahra.

var. *turcicum* Kcke.

Ears fully bearded, awns red ; chaff felted, red ; grain white.

Only one ear belonging to this variety was found in sample 4 from Shalozan, Daman.

The constitution of the seven samples of wheat received may be summed up as follows :—

SAMPLE 1.—White wheat from Shakh. Rodghara.

The bulk of this sample consisted of the strong, vigorous, red-chaffed white-grained wheat, Kurram Valley Class II (var. *erythroleucon* Al.). About one-eighth of the sample however belonged to Kurram Valley Class I (var. *ferrugineum* Al.) which is similar in outward appearance but in which the grain is pale red.

SAMPLE 2.—Red wheat from Shakh, Rodghara.

Seven-eighths of this sample consisted of a fully bearded, white-chaffed, very pale red-grained wheat Kurram Valley Class IV (var. *erythrospermum* Kcke.)

It also contained a similar wheat with white grain, Kurram Valley Class VI (var. *graecum* Kcke.) and a small quantity of a wheat belonging to var. *ferrugineum* Al., Kurram Valley Class I.

SAMPLE 3.—Red wheat from Shiblan, Daman.

About three-quarters of this sample consisted of the red-chaffed, white-grained wheat belonging to Kurram Valley Class II (var. *erythroleucon* Al.). The rest of the sample consisted of a white-chaffed, white-grained wheat, Kurram Valley Class VI (var. *graecum*, Kcke.), with small quantities of two red-grained wheats, one red-chaffed, Kurram Valley Class I (var. *ferrugineum* Al.) and the other white-chaffed, Kurram Valley Class V (var. *erythrospermum* Kcke.).

SAMPLE 4.—Red wheat from Shalozan, Daman.

This sample consisted almost entirely of a wheat belonging to Kurram Valley Class III (var. *erythroleucon* Kcke.). Small quantities of wheats belonging to Kurram Valley Class I (var. *ferrugineum* Al.), Kurram Valley Class V (var. *erythrospermum* Kcke.) and Kurram Valley Class VI (var. *graecum* Kcke.) also occurred.

SAMPLE 5.—White wheat from Zeran, Daman.

This sample was somewhat immature. The bulk (nine-tenths) consisted of the red-chaffed, white-grained wheat, Kurram Valley Class II (var. *erythroleucon* Kcke.) with small quantities of two red-grained wheats, one red-chaffed (var. *ferrugineum* Al.), Kurram Valley Class I, and the other white-chaffed (var. *erythrospermum* Kcke.), Kurram Valley Class V.

SAMPLE 6.—Red wheat from Zeran, Daman.

This sample was rather poor and not so well-grown as the others. It consisted of two wheats only. Two-thirds of the sample was composed of the red-chaffed, white-grained wheat, Kurram Valley Class II (var. *erythroleucon* Al.) and the rest to Kurram Valley Class I (var. *ferrugineum* Al.) which is similar in appearance but has red grain.

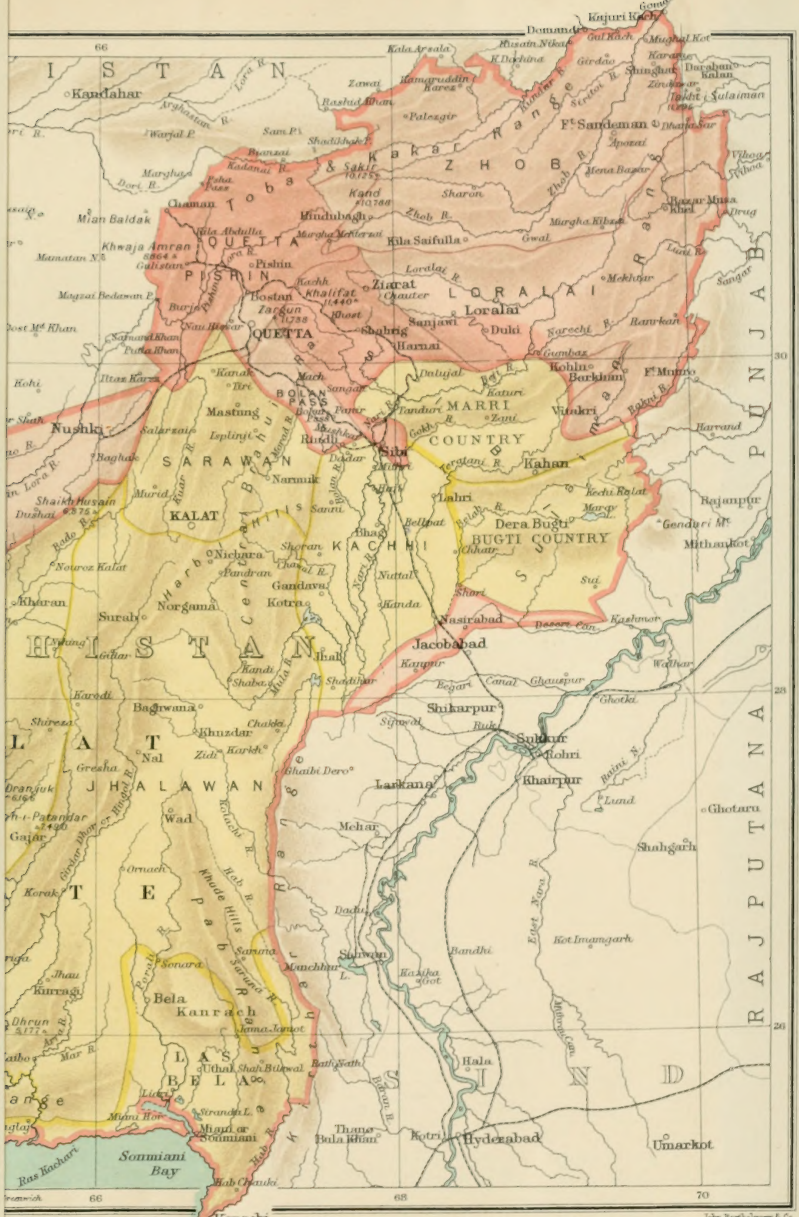
SAMPLE 7.—White wheat from Parachinar, Sahra.

This sample was the most mixed of all. It was impossible to make out which was the main constituent. About one-third of the sample consisted of the red-chaffed, white-grained wheat, Kurram Valley Class II (var. *erythroleucon* Kcke.), about one-third belonged to the white-chaffed, red-grained wheat. Kurram Valley Class V (var. *erythrospermum* Kcke.) and the rest consisted of small quantities of the wheats, Kurram Valley Classes III and VI.

The most striking point about the Kurram Valley wheats is the paucity of varieties. There are only four varieties and six classes. Only common wheats occur, the black-awned macaroni wheat so common in the North, *i.e.*, in the Punjab, Baluchistán and Khorásán, is absent. The wheats are very similar in appearance. They are all fully bearded with smooth chaff. Only one tone of red is present in the chaff colour, a brownish red with a kind of bluish bloom overlying it, somewhat similar to the chaff of Punjab Type 12 but without the blackening of the awns found in this type. The straw in many of these wheats shows the peculiarity observed in several of the Punjab wheats, viz., a pink colour before maturity which turns grey or black on ripening. One interesting point is the occurrence in two cases, Classes II and III and Classes IV and V, of two wheats morphologically identical except as regards glume-shape, grain-shape (which is of course correlated with the shape of the glume) and tone of colour of the grain.

The consistency of the grain of all the kinds was soft and no indication of quality could be observed. They appear all to be essentially weak wheats of poor quality. The grains were not well-filled. It is probable that, as everywhere on the Frontier, wheats with a somewhat shorter growing period would give a better sample of grain and would grow more profitably. Both earcockle and bunt were found in the samples.

Pusa:
October 28, 1915.


I S T A N
Kandahar
Lora R.
Arghestan R.
Warjal P.
Sam P.
Buanzai
Kadanai R.
Marghaz
Zeha Pass
Dori R.
Chaman
Tobs
Mian Baldak
Khwaja Amran 8664 ft.
Manatan N.
Maqzai Bedawan P.
Mast Md. Khan
Kohi
Shah
Nushki
Baghuk
Shaikh Husain 2575 ft.
Dushai
Bodo
Nouroz Kalat
Kharan
Surab
Gichang
Gollar
Karadi
Baghwana
Shireza
Nal
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